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ABSTRACT

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FINAL REPORT

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THE DESIGN AND TESTING OF A COMPUTERIZED METHOD OF HANDLING LIBRARY PERIODICALS (Title III)

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I. INTRODUCTION

A. Statement of the Problem.

For many years librarians have wrestled with the problem of predicting the dates of arrival for their incoming periodical issues. Arrival information has important implications for the optimum allocation of library resources and the subsequent control of staffing patterns, for file organization, for the scheduling of work loads, and for storage space requirements as well as in the application of computer processing of serial records. In addition to its effect on the allocation of resources in the Serials Dept., the date when a journal issue arrives (hereafter called the arrival date) activates a number of other library processing operations or modules which may or may not be part of a Serials Department. Operation of the binding, subscription control, and claiming modules are dependent upon the arrival or non-arrival of an anticipated issue within a specified period of time. Thus we have three large areas of library processing where action depends upon and is triggered by the arrival of a single journal issue. These are check-in, claiming, and binding. It is important, therefore, that librarians know as much about the pattern of arrival and the predictability or unpredictability of its time dimension as possible.

The correct engineering of an arrival code will insure the successful operation of these three modules, incorrect engineering will merely result in the exchange of one file for another, and the failure of these modules to interact properly. The triggering mechanism responsible for their activation is the receipt or, in the case of the claiming module, non-receipt of an expected issue. The library profession's lack of success in this area is attested to by the prevalence of large all-inclusive arrival intervals and by the massive tub files which many automated Serials Departments presently use to hold tab cards for issues whose arrival is pending. Indeed, one of the major reasons for the failure of all broad based serial arrival codes has been the attempt by their developers to force arrival dates to conform to a predetermined arrival pattern (weekly, monthly, daily, quarterly, bimonthly etc.) rather than allowing the issues themselves to set their own pattern as they arrive, and then to forecast the next issue's arrival on the basis of this self-generated pattern, instead of using some statement given by the editor or appearing on the masthead.

At the center of this entire problem is an understanding of a journal's arrival frequency behavior and its concomitant arrival pattern. Knowledge of these twin concepts by library management has been intuitive up to now. Prior to this research there was no systematic technique by which the library decision maker could collect and

analyze the historical data upon which to base his decisions in this area.

Several problems indirectly related to this research but of interest to the library profession at large have surfaced during this investigation. Most of these are problems created by editors or editorial boards who do not understand or care about the bibliographic process and the need to be able to identify their products. Many of these publications are sponsored by professional groups who should be well acquainted with the importance of the printed word and the publication process. Nevertheless, they persist in multiplying their professional journals by dividing and subdividing them with little or no thought for the user who must locate a piece sometimes identified only as being part of a sequence within another sequence. They change numbering schemes almost at random. Editors will often leave out or start over issue and volume numbers as though they never existed and occasionally, even change titles - sometimes for highly suspect motives. Or they may change the frequency with which a publication is issued and tell no one, while attempting to correct numbering errors by using the same number twice (on a different issue), or by simply leaving out a number altogether. All of which has helped to magnify the chaos in a library's records and assists no one in finding or using their journals.

Crismond (11) has recently pointed out the fallacy in the professions thinking about serials as by definition having a regular publication schedule and following a predictable numbering scheme when in reality a large number do not fall into such neat categorical patterns. This should suggest to the profession at large that a new definition for serials must be found - one more closely attuned to the actual nature of the publication itself.

B. Hypothesis.

That it is possible to design a continuously operating self-adjusting arrival algorithm for periodicals which will enable any serials librarian to anticipate the arrival of the next issue (both when it is due and what is to come) for any journal having a predictable arrival pattern.

C. Goal of This Research.

This study proposes to develop and test in a library under actual operating conditions the feasibility of a self-generating homeostatic arrival interval for all fixed interval serials, hereafter called periodicals. It will also seek to determine if there exists a single optimum expectancy band or confidence interval which can be generalized to all periodicals and used with an arrival card for the purpose of checking in these periodicals. A

statistical model, or arrival algorithm, will be developed which will enable the librarian to identify and process those journals whose arrival data falls into a predictable pattern, i.e. having a predictable number of days between the receipt of each issue, by simply plugging into the model historical data from the library's check-in file. Built into this recursive algorithm will be a technique for grouping bibliographic units (parts, issues, numbers, hefte, fascicules etc.) into the next higher bibliographic level (Volume, Band, Tome, etc.) by a process which automatically increments any given bibliographic level on the basis of the arrival of a preselected number of units at the next lower bibliographic level. Such information can normally be derived from data given on the cover or title page. This empirical model must be designed in such a way that it can use the historical data (the date on which a given issue was checked-in) collected by the Serial Department in its records. Furthermore, the model must be capable of operating independently of the geographical location of the library.

It is considered essential that any proposed system be applicable to and appropriate for the varieties of processing requirements and patron needs found in many different types of libraries. It was judged, therefore, to be an essential requirement for the proposed system design that it be capable of generalization to as broad a spectrum of libraries as possible. This has also meant that however the arrival system is eventually designed it must have the capabilities of being used in the real world of library, patrons, and records, etc.

II. LITERATURE REVIEW

The literature review has reinforced this author's belief that there is widespread interest in the automation of serials processing among libraries today, with almost as many variations as there are libraries attempting to automate the processing of their serials. That portion of the library science literature devoted to serials and serial arrival codes usually discusses them in the context of library automation (data processing) and/or the applications of a computer to the operation of a Serials Department. Much of this literature describes very limited systems running on small, second generation computers operating in a batch mode (34,27). It is interesting to note that without exception each of the libraries which reported some form of automated serials check-in used the anticipatory approach, or a modification of it, to record the arrival of their serials. A high percentage of these libraries reported that their goal was to anticipate the arrival of a physical item or piece which had been uniquely identified in advance of its arrival by a combination of "predictable"

elements. Many libraries (3,12,15,24,33) preferred to estimate in advance the number (how many) and/or the bibliographic characteristics of the issues expected to arrive during a predetermined period (a week, month, quarter, half-year, year etc.) instead of focusing on the problem of anticipating the number of days which will elapse between receipt of each issue of a given journal. Exceptions to this were reported at the University of British Columbia (14), the UCLA Biomedical Library (2), and the University of New Mexico, Library of the Medical Sciences (25). Each of these libraries anticipated only the arriving title and not the individual pieces. In these three libraries information about the piece was added to the check-in card after the piece had arrived. Lawrence Radiation Laboratory (34) reports that it handles all irregular issues in this way by adding data to the volume and issue number fields only after the issue has been received.

It is interesting to note that Fayollat and Luck (31) of the UCLA Biomedical Library have estimated that they can predict all information for 70% of their serial titles and all information except year for another 20%. The remaining 10% have no predictable issue identification information. UCSD (35) has estimated that they are able to predict the arrival information for 80% of their serial titles.

Arrival frequency is used synonymously in this investigation with the phrase, "frequency of issue" and designates the planned publication interval for consecutive issues of a periodical. Up to now, investigators (3,4,5, 6,7,8,9,10) working on the design of anticipatory files have treated the publication pattern as a function of the arrival frequency, sometimes even of the date on the cover (24,34) of the piece. Because libraries have based their arrival codes, or metacodes (34) as they are sometimes called, upon the publishers stated frequency of issue, these codes are felt to be publication specific and unable to adjust to the unplanned irregular arrival intervals caused by dock strikes, postal delays and snowstorms. The solution posed here is unique in that it suggests each journal be allowed to set its own frequency of arrival making whatever allowances are necessary for the distances mail must travel as well as any acts of God or man which could conceivably affect the arrival interval. This investigation suggests that a change of emphasis is in order and examines the arrival patterns in terms of the statistical significance given to the number of 24 hour periods between issue arrivals. It does this by using as a data smoothing technique one measure of central tendency - the arithmetic mean or moving average - and the confidence interval about this sample mean.

The variety of ways in which the arrival of an issue was recorded were almost as numerous as the libraries themselves. The simplest and earliest device reported (27) was the IBM card which had been hollerith coded to show title, volume, issue, or number etc. in sufficient detail to identify uniquely the piece expected. The presence of this card was used to alert the serials clerk to an issue's anticipated arrival. In this early version it was customary for one card to be prepared, generally by the computer center, for each issue or physical piece expected to arrive within the next calendar month's time. These cards were then forwarded to the library, usually at the beginning of the month, where they were stored in a tub file until the issue itself appeared. Cards for any issues which had been received were marked and returned to the computer center where they were used to update the file, and prepare lists of newly received issues. Meanwhile, cards left over at the end of the arrival period were judged to be logical candidates for claiming. This, in its simplest form, is the way the early systems were designed to work. However, if the large number of variations are any indication, no single best way for handling serial check-in and arrival has yet emerged.

As a matter of general interest a few of the more common, as well as uncommon variations, will be reviewed in this report. The number of subscriptions reported as handled by the anticipatory method varied from the high of a national library (28) to a low of 750 titles (12). Formats received/used by libraries as their notification document vary from the basic hollerith card showing all information concerning the expected piece coded and interpreted (5,6,7,8,9,24,28), to the use of an 80 column punched card with only part of its contents machine coded (11,18,37), to an 80 column punched card coded for only Part of the identifying information and to which is added information in machine code about the issue or piece as soon as that piece arrives in the library (2,14,25), to a list of expected issues (12,15,34,37), to an edgepunched card used in a paper tape installation (3), to the use of mark-sensed cards (4).

Most libraries reported using the calendar month (5,6, 7,9,11,12,15,18,28,25) as the cycle for the computer run used to prepare the arrival document. However, some reported using weekly (2,3), quarterly (24), or annual cycles (4). One library (34) reported the use of monthly batches of turnaround cards with a daily return of cards and the receipt of a check-in printout produced in three copies each working day.

The UCLA Biomedical Library (2) has an interesting

variation on the arrival card. Under their system, cards are completed only as issues are checked-in. When an issue is received a card is pulled and sent to the computer where its presence is used to trigger the preparation of a card for the next issue. This new card is then sent to the library where it remains in the tub file until the next issue arrives. Cards for arriving journals are batched and sent from or returned to the computer once a week. In this system it is possible to correct the cards to show the latest issue received or to show the arrival of several issues for an irregular serial. This system is completely independent of arrival frequencies. When an issue arrives for which nothing except the title can be predicted, the check-in card comes with blanks for volume, issue etc. These are then keypunched with the appropriate bibliographic information. However, as the author (2) points out this system does not allow for a claiming procedure.

All the systems described in the literature were operating in the batch mode. However, several have expressed an interest in on-line operations and two libraries (13,15) indicated that research into on-line applications was underway.

III. METHODOLOGY

A. Experimental Design and Problem Definition.

The difficulties encountered in attempting to design and operate a functional issue arrival system have been categorized as follows:

1) Those involving the bibliographic and temporal identification of the physical piece due to arrive.

2) Those involving the length of the time interval which should elapse before the next issue appears.

3) Those involved in the calculation of the date (number of days plus the base date) on which the last issue was to have arrived.

4) The design and use of I/O records for capturing and/or generating the information required in 1,2, and 3 above.

The strategy adapted in attacking each of these problems will be described in the following sections.

The arrival event (E) is a function of two unrelated sets of variables, one temporal (T) and the other bibliographic (P). Bishop, Milner and Roper (1) have called attention to the existance of two similar interacting systems which may be used to identify successive issues of a journal. One of their systems is the internal numbering scheme found on the journal issues themselves, which is used to uniquely identify the piece in hand. This corresponds to the hierarchy of bibliographic variables used in

this investigation and is delineated in Table 1 of this report. The second system proposed by Bishop, Milner, and Roper is a chronological grouping which uses the nominal date of publication. In place of this second system the author has substituted the date of arrival. This date (called the temporal variable) is the element which describes the day on which an issue physically appears in a library. This is completely independent of the cover date and will usually vary from library to library. It is this shift in emphasis which makes the present algorithm independent of the geographical location of the library and, thereby, capable of generalization to all libraries.

An understanding of these two sets or classes of independent variables (temporal and bibliographic) is crucial to the operation of this predictive algorithm. Each class is composed of the elements which, when taken together, are essential for the precise identification of an anticipated issue. One set (the bibliographic variables) contains elements whose relationship with one another is essentially hierarchical. The second class usually consists of only one variable - the date of arrival. However, a second element, the hour of arrival may be added here whenever necessary. Bibliographic elements found on the physical piece have been partially described by Curran and Avram (30). The list of the generic terms used in this investigation for the bibliographic variables is based upon their work and appears in Table 1.

The characteristics of those elements which are required to uniquely identify a given issue or piece are as follows:

1) Any issue must have assigned to it one or more of the elements from each class in order to be uniquely identifiable in time and bibliography. The presence of these elements together with the title on a given piece can be thought of as analogous to the mathematical concept of coordinates in that at least one element from each class of variables is required in order to uniquely identify a point/piece in a multidimensional universe.

2) The two classes of variable - bibliographic and temporal - are regarded as being independent of one another.

3) The bibliographic elements as printed on the cover or title page will always serve to indicate the relationship of the piece in hand to the issue which came before and to the issue which follows it in a bibliographic but not always in a temporal sense.

4) Although the elements within each class are intended to be hierarchical and/or sequential in their relationship to one another, it does not necessarily follow that the arrival of the various physical parts will always follow the same pattern or appear in precisely that same sequence.

Table 1. Elements of the Temporal & Bibliographic Hierarchies Required to Uniquely Identify A Physical Piece.

Elements

Temporal	Bibliographic
1) Days from the base date	1) Edition
2) Time within a 24 hour period. Seldom used but necessary in the case of two identical copies of the same issue arriving on the same day. Not used in this investigation because of the limited size of the sample drawn.	2) Series
	3) Volume number*
	4) Part number*
	5) Issue number*
	6) Date, Day, or season as given on the cover
	7) Pages
	8) Copy number
	9) Supplement number
	10) Title as used with the spare parts

* Included here are the various synonyms used for these elements in other languages. For example, Volume=Band=Tome etc.

5) There is no device placed on the incoming piece by a publisher which can be used for the purpose of distinguishing a first from a second copy of an identical issue. By definition these are exact copies distinguishable only in a temporal fashion.

6) The elements within a single strata of the bibliographic class of variables may continue in one uninterrupted sequence or they may start over after an interval of time has elapsed or after a series of physical numbers have appeared. Thus, it often happens that numbering at one level will continue in sequence while numbering for the bibliographic strata just beneath will repeat itself after so many issues have appeared. For example, one may find in a monthly periodical that the volume numbering is continuous while the issue numbering stops and starts over again after every 12 issues.

7) There is no predictable consistency in the magnitude or title of an element from one journal to another journal. For example, journal X may have one volume in 15 months while journal Y may have one volume or one issue in 6 months. It is essential, therefore, that the relationship between bibliographic levels be individually determined and continuously monitored for each journal.

The date appearing on the cover remains an anomaly and was found to bear little if any relationship to the arrival date. Indeed, the cover date is often a source of confusion, since it creates uncertainty in the mind of the receiving clerk who must always remember whether a date written on the check-in card denotes the date an issue appeared or the date given on the cover. Because there is so seldom any predictable correlation between the date of arrival and the date on the cover of the journal issue, this relationship was judged by the author to be useless for purposes of this investigation and is, therefore, ignored; unless that cover happens to be the only "bibliographic" identification available for the piece in hand. Then it is used only for the collocation of the pieces as they appear and bears no relationship to the set of temporal variables.

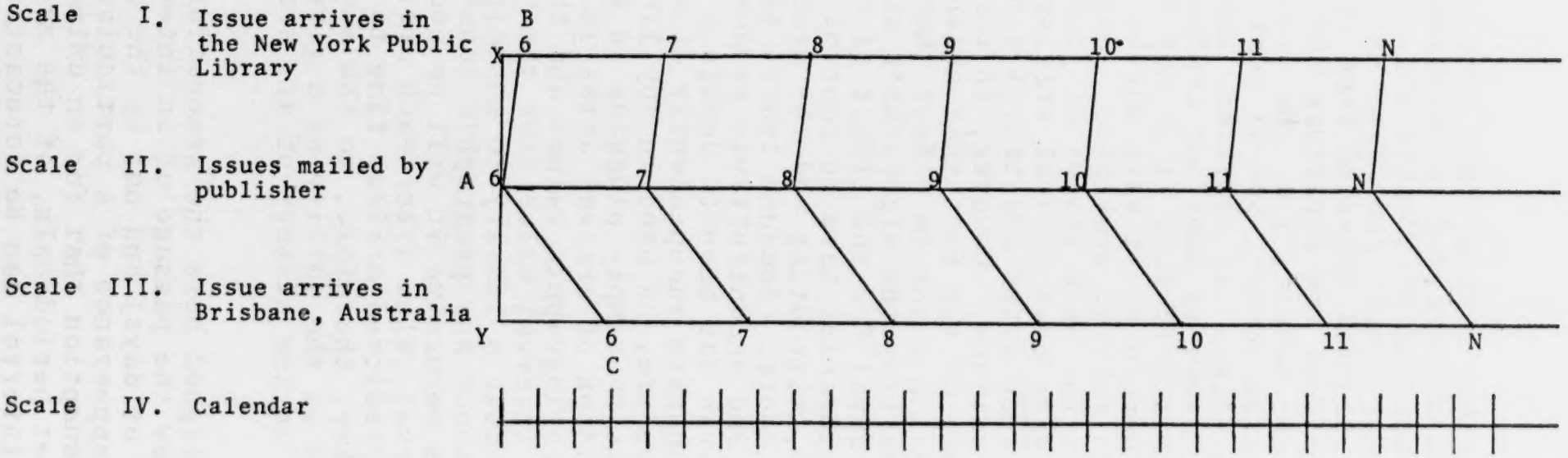
A major difficulty encountered in this investigation has been the fact that one of these groups of variables (the bibliographic) is deterministic or exact in that the relationship of each piece bearing them can be precisely related to all other pieces, while the other set of variables (the temporal) is probabilistic or subject to variation and chance causes. These differences have required that the solution use two models, a temporal and a bibliographic, for complete definition of the problem. The bibliographic model is described in the concept of bibliographic levels (See Appendix A Data Element Dictionary). The temporal model is discussed in detail in the section of this investigation

devoted to the Arrival Code Model.

The author does not wish to imply here that the time required for the same issues of a journal to travel from their origin to their destination is everywhere equal. It is reasonable to assume that an issue of journal XYZ published in New Jersey will reach the New York Public Library before the same issue reaches Brisbane, Australia, all other conditions being equal. However, the mean time interval (time between arrivals) for the arrival of issues 1,2,3...N for journal XYZ in Australia and the mean time interval between the arrival of issues 1,2,3...N for journal XYZ in New York City should be the same whether the planned publication interval is greater or less than the normal travel time between its origin and its destination. Stated another way the population mean arrival time interval for all issues of a given serial is everywhere the same and is independent of the distance traveled and the planned publication frequency for that particular journal. This will become more readily apparent if one examines the two arrival continuums and their concomitant departure continuum shown in Fig. 1. These have been scaled to show publication dates with arrival times and arrival intervals for a hypothetical journal published in Newark, New Jersey. This diagram illustrates the author's hypothesis that there is little correlation between the distance a journal must travel and the mean arrival interval. The only interval affected by distance is that between the first departure and the first arrival. An area for future investigation would be the relationship between the probability of a delay occuring and the distance a journal must travel. This author suspects a positive relationship, but no evidence was compiled for or against that premise in this investigation.

The three scales in Fig. 1 have been plotted in the form of a nomograph to show the relationship between the departures and arrivals of comparable numbered issues for journal XYZ. The center scale shows the issue number and the moment at which it was published (placed in the mails for distribution). For the sake of clarity, it will be assumed in this example that the journal is being published at intervals which are both equal and known, and that travel time (expressed linearly as the distance AB and AC with $AB \neq AC$) remains constant but not equal for both destinations. The numbers on each scale designate a bibliographic value, i.e. issue numbers. The points B and C on scales I and III represent the day on which that issue arrives in New York and in Brisbane, Australia. Point A on scale II represents the day on which any bibliographically equivalent issues (same volume and issue number) were mailed by the publisher in Newark. For example, one copy of issue number 6 was mailed from Newark and arrived in New York 5 days

Fig. 1 Time Scales Illustrating The Effect of Distance On the Length of the Arrival Interval



Intervals = 10 days

15 21

later (Vector AB). Another copy of this same issue was mailed at the same time and arrived in Brisbane 30 days after the two copies were mailed (Vector AC). Notice that the only "interval" whose length (in days) was affected by the distance that this journal traveled from its origin to its destination lies between the departure and the arrival of the first issue in the sample, i.e. the distances XB ≠ YC. This can be any issue number, but it must always stand first on the sample paradigm. In addition, the first period is not a true interval since it does not conform to the definition used in this report i.e. it is not bounded by two arrival events. Therefore, it will not be used in the calculation of our mean arrival statistic. Notice that all other arrival intervals for both issues of journal XYZ tend to cluster around the same mean arrival statistic, given given that the publication dates and travel times remain constant for all observations. However, in the real world one must take cognizance of the fact that neither is constant or predictable which means in effect that in this investigation we are testing the algorithm's ability to adjust the arrival interval for the effect of those chance variables over which libraries have no control such as postal strikes, storms, misrouting and the probability that a delay will occur en route. Because travel time remains such an unpredictable and uncontrollable random variable, the goal of this research has been to design a homeostatic algorithm which will operate independently of a library's location and can, therefore, be used in any library to anticipate its arrivals by simply plugging in the appropriate historical information of arrival dates in that library together with their bibliographic values and then calculating the required mean interval value from the sample observations. This will enable a library to anticipate both when and what to expect without any geographic constraints. Since the algorithm is recursive it will be necessary to recompute a mean interval value after each arrival and in so doing to sharpen the predicted arrival time to its best possible value. The key, therefore, to the successful use of this algorithm lies in the ability of a given library to assemble as much data on the history of its arrival events as possible.

In the system designed here the generation of a check-in card is triggered by the passage of an interval of time (a fluctuating number of days) and not by the arrival of an earlier issue or the appearance of a particular date. This study examines the assumption that for an unknown percentage of titles in the subset periodicals, of the main set serials, a realistic interval can be forecast for each title such that the arrival of the next issue can be anticipated on the basis of the previous actual arrival times taken from a sample of previous issues of this title. Furthermore,

this proposal contends that these arrival dates can be anticipated within a given confidence band called the expectancy interval. This investigation will seek to verify the existance of a single optimum expectancy interval for all titles in the subset periodicals. Or, put another way, can the librarian anticipate arrival of all serials within the work week or must an expectancy interval be derived independently for each title.

One of the greatest impediments to the successful operation of an anticipatory serial system is the difficulty of projecting arrival dates in such a way that the anticipatory tub file does not become overloaded with cards (notices) for issues scheduled to arrive. Most of the systems designed to date have attempted to predict all issues expected during a given calendar month or two-month period (5,6,7,8,9,10,34). Such an artificially created interval is not always satisfactory because it overloads the system with cards, and in the long run merely exchanges one file for another. This problem should become less acute as the interval or expectancy band during which a journal's arrival is anticipated becomes better defined.

It is a relatively simple matter to delineate the issues of a set of periodicals due to arrive within a given 12 month or even six month interval, but as this arrival cycle is shortened it becomes more and more difficult to anticipate with any degree of precision the issues due to arrive within this period. However, unless librarians wish to add another file to their already growing list some way will have to be found to keep the arrival tub file in manageable dimensions. This means for the larger libraries that a smaller, more sharpely defined, arrival period is essential if the library is to operate more efficiently by minimizing the number of cards a clerk must search through in order to locate a card for the issue in hand.

One of the basic tenets of this investigation has been the necessity for careful delineation of terms and concepts. Five core concepts have been introduced here in order to eliminate ambiguity and to enhance the reader's understanding of the entire arrival mechanism. These are the arrival code continuum, base date, expectancy band, bibliographic level, and frequency of issue.

One of the most misleading tenets of previous research has been the automatic assumption that the frequency of issue, sometimes called the arrival frequency, articulated in the generic terms daily, weekly, monthly, quarterly etc., and usually displayed on the journal itself, is always identical with or an adequate gauge of the arrival interval. Early in this investigation consideration was

given to the use of the publisher's statement regarding the frequency of issue of his journal as the best interval forcast. This strategy was abandoned for several reasons. Over the years librarians have developed a deep distrust for statements of planned publication, and with good reason, since they are so seldom followed. Furthermore, such statements come in a variety of forms. For example, typical statements are nine times a year; quarterly; in January, March, May, July, September, November; and Fall, Winter, Spring, Summer. These have little value in helping to anticipate an arrival date for a journal can be early or late (more likely the latter) and even if it were punctual a journal published in March in the Northern hemisphere will seldom reach India or South Africa before April or May, and in all likelihood its arrival date will vary depending upon a variety of factors over which there is no control either by librarians, publisher, or journal. It is misleading to assume that because a journal is labeled as a weekly or a monthly one issue will always automatically appear in a given library within each week or each month's timespan. Nor is it possible to assume that because a journal is a quarterly it will be published regularly in January, April, July and October. It may be a quarterly and published in January, April, July and October. The fact that it is quarterly does not necessarily mean that it will be published in any particular month. Nor does the fact that it is published in these months necessarily mean that it is a quarterly.

These artificial and highly misleading relationships have been promulgated by both editors and serial librarians. Such terms are misleading for the above reasons and encourage one to infer a degree of regularity and predictability in a journal's arrival which is seldom seen. They are also misleading in that they have caused several investigators attacking this problem to categorize arrival intervals using these very same terms regardless of their applicability. This is a completely false interpretation because so few arrivals fit into the neat patterns of periodicity suggested by the publishers in their planned frequency of arrival statements. Because of these difficulties the author has chosen a different method of attack on this problem, one which uses only the arrival interval as it is established for each library, as the principal key to gaining a better understanding of the arrival date and the necessary prediction of interval size.

B. Difficulties Encountered In The Experimental Design.

Of the problems encountered in the design of this research, the more complex and difficult to understand have been those problems centering around the temporal variables. The best way to examine them was judged to be that of gain-

ing an insight into the behavior of the arrival interval itself - its characteristics and dimensions (both bibliographic and temporal). Therefore, major emphasis was placed on acquiring an understanding of the arrival interval and its relationship to its boundaries - the arrival events. This is important because the interval computation by itself is useless in the calculation of the next arrival date. It must be pegged to or measured from a previous arrival date (T). The interval then becomes a quantifiable entity whose dimension is determined by the boundary dates on which two bibliographically sequential pieces (part, issue, or number) of a journal arrived in a particular library. It is expressed as the number of 24 hour periods which have elapsed between these two arrival events.

This investigation has assumed that the time of arrival varies from library to library for similar issues of the same journal and that even predictable patterns will vary slightly due to unknown causes totally out of the control of the publisher or editor. Indeed, there is very little about a single interval viewed by itself which is predictable. Even its existance cannot always be assumed for when two issues arrive together or when one issue is assigned two bibliographic numbers by an editor there is no time interval between their appearance, a condition referred to in this report as a zero interval. However, when journal arrival intervals are studied in the aggregate, it is possible to generalize about their behavior.

Several different types of arrival intervals were identified in this investigation. These are discussed in more detail in the Data Element Dictionary (Appendix A) attached to this report. They are as follows: the normal arrival interval, the zero interval, and the negative or cross-over interval resulting when one issue arrives out of sequence, thereby causing one arrival interval to be nested inside another. This latter happens when one issue is very late and other issues continue to arrive in the meantime.

As previously noted most of the early solutions to the problem of predicting when an issue will arrive adopted an a priori approach. This was not based on study or examination of the problem, but used instead either the very artificial frequency of issue statement given by the editor, or sometimes even an arbitrarily selected interval into which all expected issues were batched such as a monthly arrival tub file. This research tests the validity of a very elementary statistical approach whose basic premise is that the size of the next anticipated interval can be predicted (with the exception of those intervals arbitrarily changed by fiat from an editor or publisher) using one very simple measure of central tendency - the arithmetic mean -

combined with the standard deviation to eliminate any arrival intervals which are ± 2 standard deviations away from the mean. This data smoothing technique utilizes a weighted moving average which does not ignore old intervals as new intervals are added but, because not all arrival intervals are of equal importance (zero intervals are ignored in calculation of the mean), uses a built-in technique for minimizing the effects of those intervals which might cause a misleading or unreal prediction by eliminating intervals which fall more than two standard deviations away from the sample mean. A comparison of the confidence intervals using this method with one using all the data can be seen in Appendix E and will be discussed under the Findings section of this report. In using this methodology the investigator has assumed that the distribution of the arrival intervals about the sample mean is normal.

C. Design Constraints and Data Parameters.

The arrival card module and its algorithm for predicting arrival dates must be capable of operating in a functional environment where it can be designed and tested *in vivo* using the context of a total systems approach. In addition, any proposed system configuration for an arrival card module must be capable of fitting, as a working module, into a totally automated serials system. This means the new system must have an interface capability with binding, claiming, holdings update and check-in modules. Although no work was conducted on any of the above modules, the author felt that it was important to show the nature of this relationship in order that work on the arrival module does not become insulated from the real world of library operations.

The sample for this study was drawn in a systematic rather than random fashion. This was done in order to assure that those journals whose arrival patterns appeared on visual inspection to exhibit some degree of regularity could be selected and tested. Systematic selection has also assured that the sample will contain a broad spectrum of journals published overseas.

For many years Colorado State University Libraries has checked in its periodicals by recording precisely the information (volume, issue, and arrival date) needed for this investigation. This fortuitous circumstance has enabled the investigator to expand the sample to 244 periodicals (See Appendix F) selected from 24 countries scattered over the world. In this mix of titles there were 9 planned arrival intervals represented. See Table 2, Distribution of the Sample By Country and Planned Frequency of Issue.

In addition to the above, the following general con-

TABLE 2 Distribution of the Sample By Country and Planned Frequency of Issue

Country \ Planned Publication Frequency	2/year	3/year	4/year	6/year	8/year	10/year	12/year	26/year	52/year
1. United States (152)		1	44	22	1		74	3	7
2. Argentina (1)		1							
3. Australia (1)							1		
4. Belgium (2)			2						
5. Brazil (2)			2						
6. Canada (7)			2	1			4		
7. Czechoslovakia (1)				1					
8. Denmark (3)						1	2		
9. England (27)	1	2	12	2			9		2
10. France (3)			1	2					
11. Germany (6)							5		1
12. India (5)		1					4		
13. Ireland (1)							1		
14. Italy (3)			1				2		
15. Japan (6)			1	1			4		
16. Kenya (1)			1						
17. Mexico (1)			1						
18. Netherlands (2)			1	1					
19. New Zealand (4)			2	1			1		
20. Poland (1)			1						
21. Russia (5)							5		
22. Scotland (4)		1	3						
23. Sweden (3)					1		2		
24. Switzerland (3)				2			1		
TOTAL = 244									

straints governed the overall planning and protocol of the research discussed in this report:

1. It is desirable that the proposed system be able to state with a predetermined degree of assurance (for this investigation set at 95% and 99% confidence) that an issue will arrive within ± 2.5 days of the arithmetic mean of all previous arrival intervals.

2. Two arrival documents will be used in order to give more information to the check-in clerk, to minimize card handling, to aid in the correction/up-date process, and to facilitate the notification to other library staff of new arrivals. These documents are the issue arrival list (IAL) and the issue arrival card (IAC). Examples of each are given in the Appendix to this report.

3. Both documents will be sent to the library once a week by the Computer Center. IAC cards will be returned daily to the Computer Center (now sent 3 times a week because of the distance and the frequency of courier runs).

4. Only one "expecting card" is permitted for each anticipated issue.

5. Return of the "expecting" card to the computer is not necessary for the program to generate a new "expecting" card. The generation of a new card is, therefore, not controlled by the return of an IAC card or the arrival of an earlier issue, but rather by an algorithm which uses the aggregate of previous arrival intervals.

6. The number of "expecting" cards in the library tub file for issues not yet arrived must be kept to an absolute minimum.

7. Data collection must always begin with the first issue of a physical volume for purposes of the binding module and the bibliographic incrementing of periodicals whose issue numbering is continuous.

8. This algorithm has been tested only on those journals whose "planned" arrival frequency is regular. No attempt was made to test the algorithm's ability to accommodate the journal whose arrival frequency was unverifiable, or the journal whose arrival frequency is regularly irregular, i.e. with a planned interval or intervals purposely unequal to the others.

9. Inferences about the size and behavior of the interval are applicable only to those intervals which result from the same planned publication frequency and belong to the same population. Thus when a publication changes its frequency (from quarterly to monthly for example) new calculations must be made and new inferences drawn.

10. No attempt was made to design an algorithm which would fit every possible contingency that may arise in the checking-in of serials. Both the publication and the arrangement of serials are extremely complex affairs. It

was judged, therefore, that this investigation would have its broadest applicability if the exceptions in serials processing were ignored.

11. For the purposes of this investigation dates of arrival at C.S.U. are equated with the dates of check-in at C.S.U.

Sample observations (dates of check-in at C.S.U.) were drawn from those titles listed in the Colorado State University Libraries kardex file. The following constraints have governed the sample selection of journal titles on which the algorithm is to be tested:

1) The sample must conform to the USASI (26) definition of a periodical. And no journals will be used whose history, as indicated by the kardex, shows irregular or unpredictable behavior.

2) It must include a broad spectrum of planned arrival frequencies in order that as many different planned intervals be represented as collection procedures will allow.

3) Only journals which are alive as of the date on which they were chosen will be used.

4) Only journals which can supply a minimum of 10 discrete readings will be accepted. Preference should be given to journals which exhibit long continuous runs. Any journals which have acquired large backfiles in one purchase should also be avoided. Intervals which equal zero will not be counted in the sample selections.

5) All journals used must be issued at intervals of less than 365 days.

6) Part of the sample journals chosen must be published overseas.

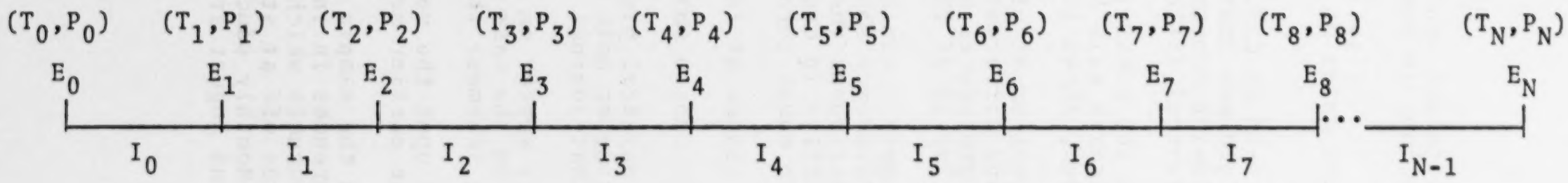
7) The sequence in which the physical pieces are issued must follow the numbering or dating or both as it appears on each bibliographic unit of that journal in a predictable pattern.

8) Where two numbering schemes appear on one physical piece (two parts bound as one or in the case of a translated journal using both numbering schemes) the longer uniform run will be selected and used.

9) Calculations will be based upon the most recently received issues and not on some earlier segment of the file.

10) No journal was included in the sample whose arrival pattern contained planned differences in interval values. For example, there are many journals which are regularly irregular, i.e. turn themselves off at stated periods during the publication cycle. Monthly education journals which do not publish in July and August are typical of this type of behavior.

Fig. 2. Arrival Code Continuum



D. Arrival Code Model.

As stated earlier this investigation has focused its attention on the four problem areas involved in the design and use of an arrival code. Two of these problems - design of the I/O documents needed for an anticipatory system, and the prediction of the bibliographic values attached to each anticipated piece - are relatively minor and have been described elsewhere in this report. This section will focus on the design and operation of the arrival algorithms using as a paradigm the predictive model graphically illustrated in Fig. 2, The Arrival Code Continuum. The operation of this model will be described both mathematically and in narrative form.

The problem of forecasting when the next issue should arrive is best studied by separating it into two problems. One involves the calculation of an interval such that when this value (I) is added to a computed base date (T) it will yield the best possible next predicted arrival date ($\hat{T}$). The second problem involves the calculation of a date (T_a) on which the last issue should have arrived. This is necessary in order to obtain a relevant base date which when summed with the arrival interval will result in the best possible predicted arrival date. This step was found to be essential in order to minimize the effects of errors which arise in the capturing of data (incorrect dates resulting from transposed digits and/or carelessness) as well as in the unpredictable fluctuations of the arrival dates themselves.

The following notation is used in Fig. 2 and in the equations below:

T_i = the number of days from a base date arbitrarily set at January 1, 1900.

T_a = the date on which the last issue should have arrived.

I_i = the arrival interval written as the number of days between arrival events.

M = the degrees of freedom + 1 after the three iterations in the data smoothing computations.

n = the number of base dates in the sample. This is equal to the number of issues which have arrived.

n' = the number of intervals in the sample.

s_i = the standard deviation of all recorded intervals in the sample.

E = the arrival event as defined by T_i and

P = the bibliographic values (volume and issue number) attached to that piece.

The dimension of any given interval is described as:

$$I_i = T_{i+1} - T_i. \tag{1}$$

The next anticipated time (T) of arrival is forecast as the sum of the date on which the last term should have arrived plus a computed mean from all previous intervals.

$$\hat{T}_{a+1} = \bar{I} + T_a. \tag{2}$$

The mean interval is computed from

$$\bar{I} = \frac{\sum_{i=1}^{n'} I_i}{n'} \text{ for all } (\bar{I}-2s_I) \leqslant I_i \leqslant (\bar{I}+2s_I), \tag{3}$$

where s_I, the sample standard deviation is

$$s_I = \left[\frac{\sum_{i=1}^{n'} (I_i - \bar{I})^2}{n' - 1} \right]^{1/2}, \tag{4}$$

and the date on which the last issue should have arrived is calculated to be

$$T_a = \frac{\sum_{i=1}^{n} T_i}{n} + \frac{n - 1}{2} \left[\frac{\sum_{i=1}^{n'} I_i}{n'} \right]. \tag{5}$$

Using the above computations 95% and 99% confidence intervals are calculated for the next issue's arrival centered around the point $\bar{I} + T_a$. Formulas for these confidence intervals are given in[a] equations 6 and 7 with calculated intervals for the sample shown in Appendix E. Equation 6 gives a 95% confidence interval for the next issue's arrival.

$$\bar{I} - t_{(.025,df)} \sqrt{(1+\tfrac{1}{M})s^2},\ \bar{I} + t_{(.025,df)} \sqrt{(1+\tfrac{1}{M})s^2}, \tag{6}$$

and equation 7 gives a 99% confidence interval

$$\left[\bar{I}-t_{(.005,df)}\sqrt{(1+\frac{1}{m})s^2},\ \bar{I}+t_{(.005,df)}\sqrt{(1+\frac{1}{m})s^2}\right] \quad (7)$$

The following is a narrative summary of the above equations indicating the steps followed by a library in using this algorithm. Assuming that the algorithm (equations 1-7) has been placed in the computer in suitable form, the model is then fed the arrival dates just as they appear on the kardex. These are converted into the number of days (T) from the base date by the computer. Each (T) is then subtracted from its successor to give an arrival interval. From the raw interval values a working mean and variance (s^2) are computed using all the data acquired up to this point. These are then used to recalculate a sharpened mean interval value by calculating a new mean and variance through 3 iterations dropping each time those observations more than 2 standard deviations away from the new mean. The iterations are used to minimize the effects of poor data, clerical errors in the transcription of information, and the exceptional interval created by dock or postal strikes, weather conditions and other unforseen delays in the mail. This computed best mean interval value is then summed with a recomputed dat T_a (when the last issue should have arrived) yielding an anticipated arrival point. However, because of the nature of this date we can expect as many arrivals before as after it, a situation completely unsatisfactory as far as predicting arrivals in a library is concerned. In order, therefore, to enable the serials librarian to control the number of arrivals he wishes to anticipate a confidence interval is then constructed around this point. This confidence interval (also called the expectancy band) enables the library to determine when it can begin expecting the next issue by converting the left hand confidence limit into a month, day, and year. When this date is reached the expected issue appears on the IAL and an issue arrival card is prepared for it. Three additional points need to be brought to the readers attention in connection with the confidence intervals used here. Most of the samples drawn were small samples. As a result the confidence intervals may seem unnecessarily large. However, as the sample size increases the size of the interval will generally decrease (38). Secondly, confidence interval statements apply only to the population being studied (38), so that a confidence interval must be ascertained for each title. This means that correct use of the algorithm requires that equations 1 through 7 be recomputed each time an issue arrives and a new issue is anticipated. And finally, confidence intervals cannot be transferred from title to title

even though each may have the same publication frequency.

E. Record And File Format.

The file as stored in the computer consists of 80 character card images blocked into five (400 character) records. This file is kept on a magnetic disc in random order where it can be sorted by SIN, by card type, and by bibliographic level. At present each record consists of four types of cards:

A. 05 01 Name Card 1
B. 05 02 Name Card 2
C. 05 03 Name Card 3
D. 05 07 Arrival Card

Each card is identified by a serial identification number (SIN) which it has in common with all other cards for that journal. All SIN numbers are assigned by the Serials Librarian at the time the journal is added to the file based upon the ALA filing rules.

Card Cols.	Function
1-10	Serial Identification Number
11-14	Card Type
15	Reserved for file update action using the following operational codes.

Signal	Operation
A (or blank)	Add to file (no check is presently made to detect duplicate cards)
D	Delete this record from the file
R	Replace what is now in the file at this position with what is on this card.
X	Purge all arrival cards beginning with this one and after.

Remark: In the case of an 05 07 card, a match is made on both SIN and the bibliographic levels given in cols. 46-65.

Card Cols.	Function
16	Unassigned
17-21	Date on which the volume and issue were expected to arrive had they been following the normal arrival pattern.
22	Override Code. Used to ignore:
22-1	This issue in all arrival calculations

Card Cols.		Function
	22-2	All previous issues in all arrival calculations
	23	Increment Code. A device for placing into the publication pattern a dummy arrival interval(s) for those journals which deliberately miss one or more publication cycles. These are planned omissions deliberately inserted with advance notification by the publisher. For example, education journals which turn themselves off during the summer months. This information is captured for the file by using replace logic on the IAC for that issue first scheduled to appear after the omission. The number of missed intervals is placed in the increment box with all information for that issue. This tells the computer to bypass in the future X interval(s) between the publication of a and b issues of the journal.
24	24-1	Claim Code Prepare a claim for this issue which is now overdue
	25	Copy Number
	26-45	Title of Journal. Placed on disc as a full title. Used on the IAC as a 4x20 title in which each word of a title is allowed to display only its first four letters except for the last word of the title which is not truncated until the 20 character field is filled.
	46-65	Bibliographic Levels. Contained in four fields of five columns each with zero fill and left justification with the first character in each string always a letter.
	66-75	Edition Statement
	76-80	Date on which the piece is checked into library given in the order day, month and year.

F. Information Capture And I/O Documents.

Information for the start up of an arrival card module is captured in the following manner: all data which could be captured from the library kardex file is written onto a general purpose Data Collection Form. An example accompanies this report as Appendix B. This form is used in the initial stages of data capture and is the document from which the keypunch operator prepares input. It can be used to add, delete, or replace information in the file. This information includes the journal's full title; the edition statement; copy number; place of publication; the date, volume, and issue number when data collection is to begin, and when to cease (used for the purpose of generating first cycle input cards); a number indicating the frequency or planned number of issues for a calendar year; dates when each claim was sent up to four; the full generic title for each bibliographic level with their corresponding increment numbers; and whether issue numbering is continuous or not. Space was left across the bottom of the Data Collection Form for adding to the holdings records such irregularly appearing pieces as indices, title pages, tables of contents, supplements, and any other unplanned-for paraphanelia which may accompany a journal subscription. Also available on this form is space for a call number (to be used when it becomes necessary to examine the journal on the shelf), space for the date and name of the person transcribing the information, and finally space for the operation codes which describe how the information is to be placed into the file. Whenever necessary, the following additional information may be obtained by examining the journal itself or from other library tools: the assigned Serial Identification Number; CODEN when they are available; and the number of physical pieces bound together not counting space parts. The data collection form is then forwarded to the Computer Center where it becomes input to the data base. See Fig. 3 Flow Chart For Activation And Update of the Arrival Card Module.

Across the bottom of this form is a section for Notes. This is used to add any additional information to the file and to note those months in which a journal turns itself off. See Increment Code discussed under Card Col. 23 supra. This information is first coded in a binary then octal fashion with a 1 indicating that an issue appears in a given month and a 0 indicating there is no issue expected that month.

The form collects information about the file according to the following rules:

1. Complete titles are printed in capital letters.
2. Where no CODEN is available from the CODEN index (36) the symbol A6 will be substituted.

Fig. 3 FLOW CHART FOR ACTIVATION AND UPDATE OF THE ARRIVAL CARD MODULE

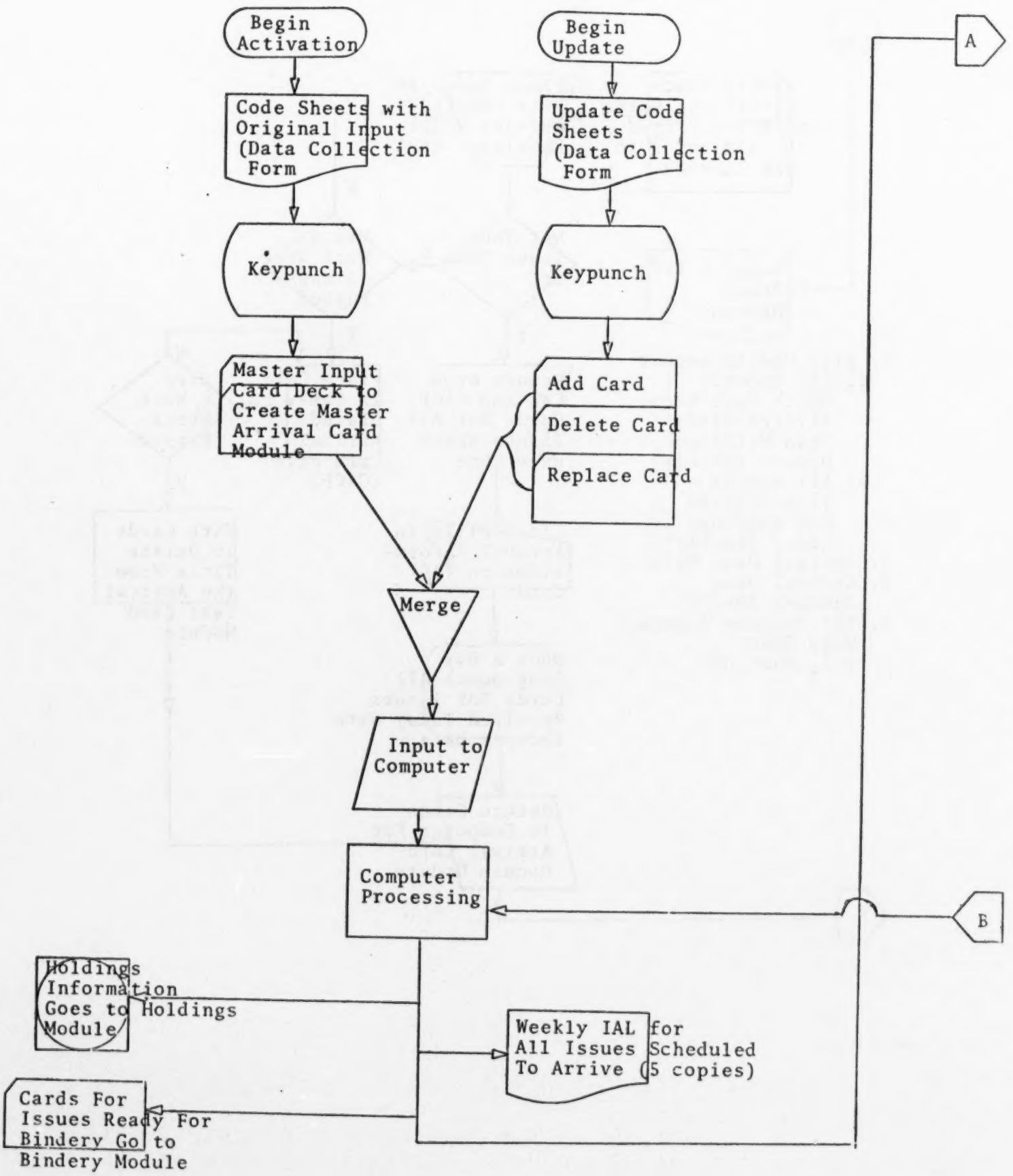
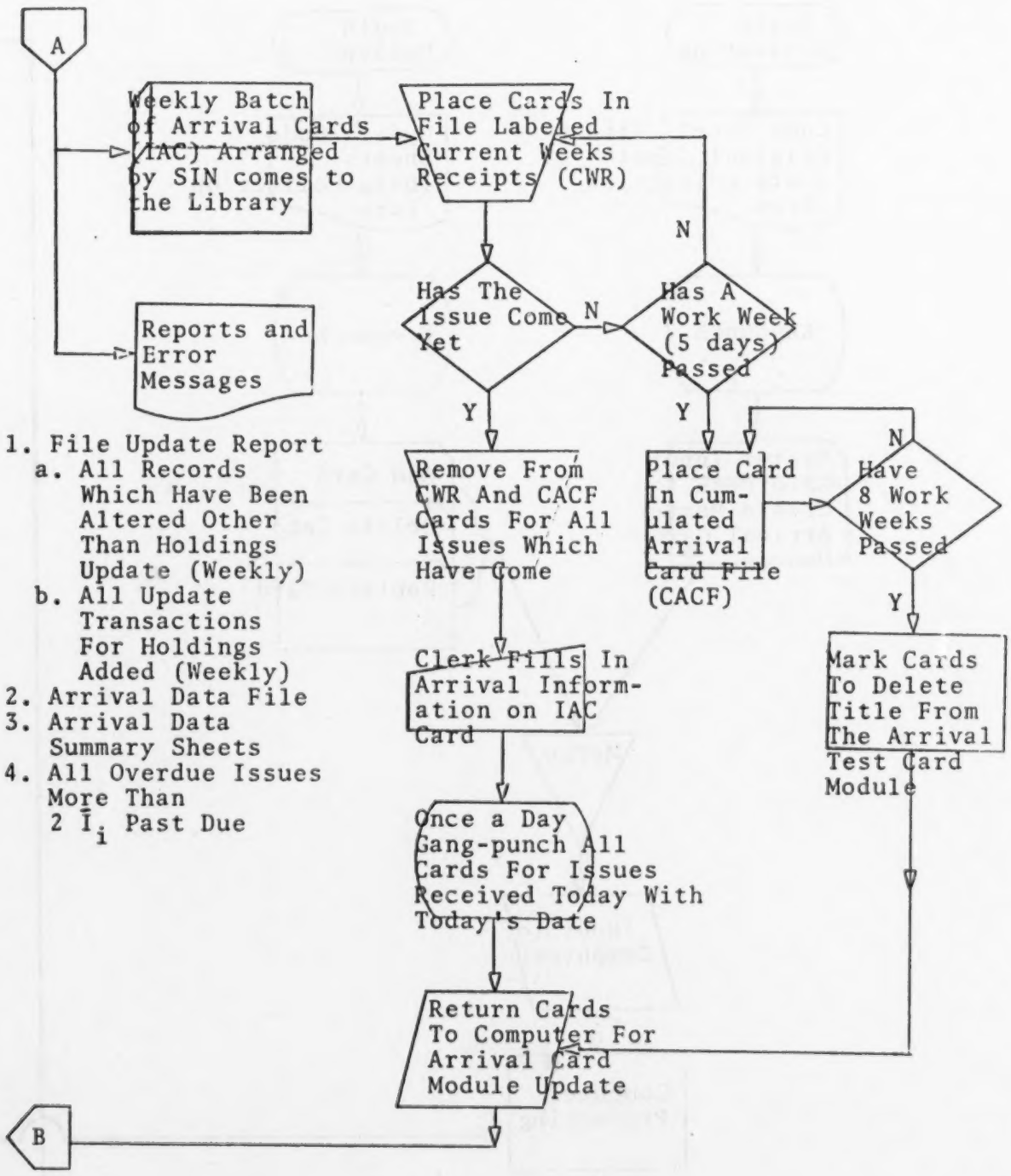


Fig. 3 Continued


A
Weekly Batch of Arrival Cards (IAC) Arranged by SIN comes to the Library
Place Cards In File Labeled Current Weeks Receipts (CWR)
N
Has The Issue Come Yet
N
Has A Work Week (5 days) Passed
Y
Y
Reports and Error Messages
1. File Update Report
a. All Records Which Have Been Altered Other Than Holdings Update (Weekly)
b. All Update Transactions For Holdings Added (Weekly)
2. Arrival Data File
3. Arrival Data Summary Sheets
4. All Overdue Issues More Than 2 $\bar{I}_i$ Past Due
Remove From CWR And CACF Cards For All Issues Which Have Come
Clerk Fills In Arrival Information on IAC Card
Once a Day Gang-punch All Cards For Issues Received Today With Today's Date
Return Cards To Computer For Arrival Card Module Update
Place Card In Cumulated Arrival Card File (CACF)
N
Have 8 Work Weeks Passed
Y
Mark Cards To Delete Title From The Arrival Test Card Module
B

3. Edition and copy numbers must be used when they appear on a library's records.

4. Data collection must always begin with the first issue of a bound volume.

5. Frequency statements will be given as the planned number of issues per year.

6. The number claimed is not used at present, but will be tallied each time a claim notice is generated by the computer.

7. Increment numbers express the relationship(s) between bibliographic levels and are the number of pieces required to increment the next higher bibliographic level by one. If the numbering of the second level is continuous the increment number bears a plus sign, if it starts over again after so many numbers the sign is negative.

8. No arrival dates for spare parts have been used or recorded in this research.

9. The SIN is a local processing number assigned by each library for massaging its own data file. It is unique to that library and is used both as an address and as a sorting device.

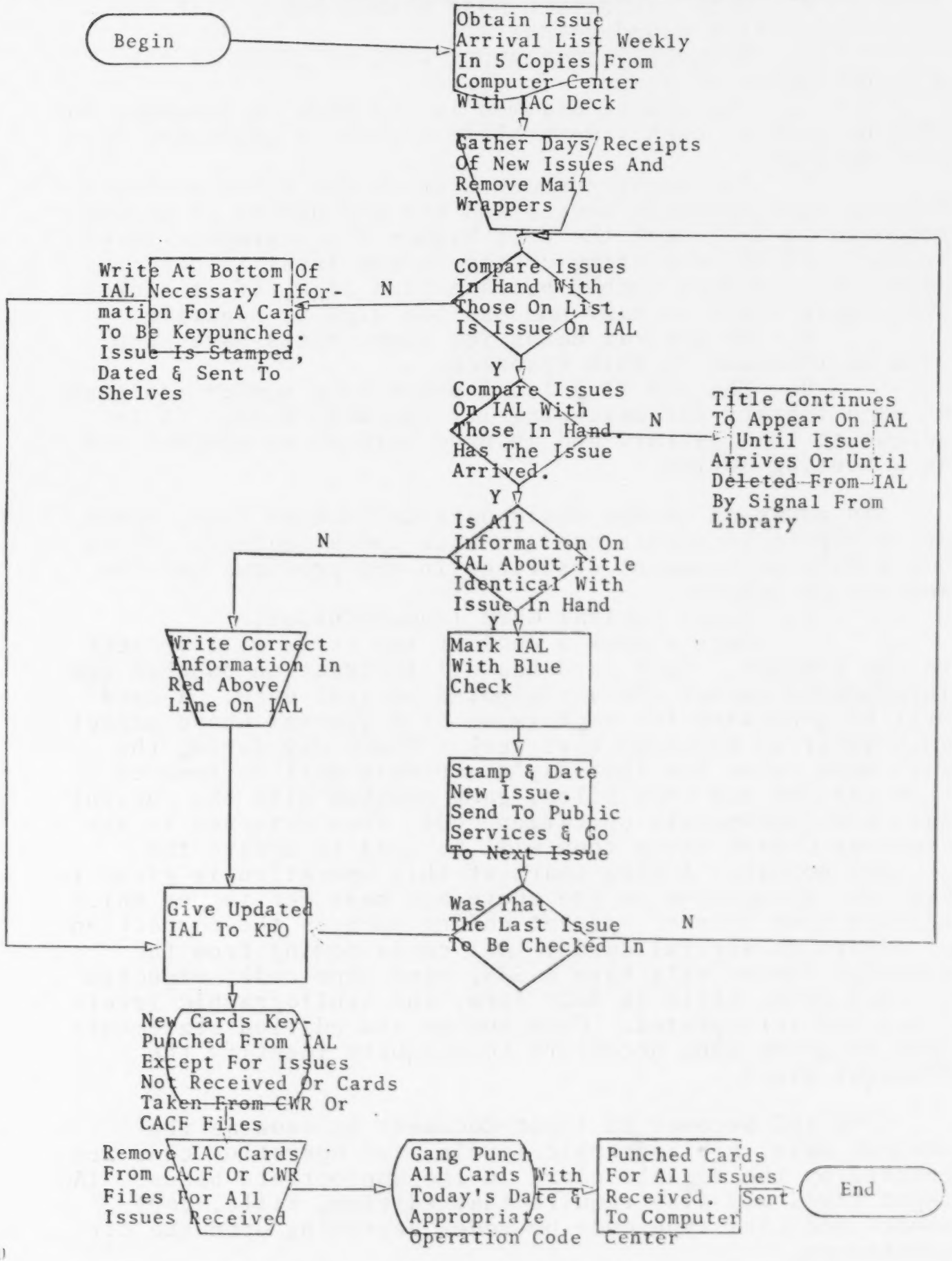
In addition to the basic data collection form, there are 6 report documents used in this investigation. These use a data arrangement described in the previous section and are as follows:

1. Issue Arrival Card (Input/Output)

Once a week a deck of tab cards will be sent to the library. Each card has all information punched and interpreted except the anticipated arrival date. A card will be generated for each issue of a journal whose expectancy interval overlaps that week. Every day during the work week cards for that day's arrivals will be removed from the CWR and CACF files, gang punched with the current date and appropriate operation code, then returned to the Computer Center where they will be used to update the arrival module. A flow chart of this operation is given in Fig. 4. Exceptions to the above are made for issues which require some type of special coding such as the correction of errors on arrival cards. All cards coming from the Computer Center will have a SIN, card type code, expected arrival date, title in 4x20 form, and bibliographic levels coded and interpreted. Copy number and edition statements will be given when necessary to uniquely identify the physical piece

The IAC becomes an input document as soon as the arrival date, bibliographic levels, and operation code are entered by the serials clerk in the appropriate boxes. IAC input cards may also require that edition, title, copy number and card type code be added depending upon the circumstances.

Fig. 4 Check-in Logic For Serials Using The Issue Arrival List (IAL) And Issue Arrival Card (IAC)


Begin
Obtain Issue Arrival List Weekly In 5 Copies From Computer Center With IAC Deck
Gather Days Receipts Of New Issues And Remove Mail Wrappers
Compare Issues In Hand With Those On List. Is Issue On IAL
N
Write At Bottom Of IAL Necessary Information For A Card To Be Keypunched. Issue Is Stamped, Dated & Sent To Shelves
Y
Compare Issues On IAL With Those In Hand. Has The Issue Arrived.
N
Title Continues To Appear On IAL Until Issue Arrives Or Until Deleted From IAL By Signal From Library
Y
Is All Information On IAL About Title Identical With Issue In Hand
N
Write Correct Information In Red Above Line On IAL
Y
Mark IAL With Blue Check
Stamp & Date New Issue. Send To Public Services & Go To Next Issue
Was That The Last Issue To Be Checked In
N
Give Updated IAL To KPO
New Cards Key-Punched From IAL Except For Issues Not Received Or Cards Taken From CWR Or CACF Files
Remove IAC Cards From CACF Or CWR Files For All Issues Received
Gang Punch All Cards With Today's Date & Appropriate Operation Code
Punched Cards For All Issues Received. Sent To Computer Center
End

2. Issue Arrival List (Output)

Comes to the library once a week in five copies. Each day's arrivals are noted in pencil with today's date. At the end of each working day one copy of the IAL is sent to the keypunch operator who prepares cards to update the file and/or removes cards for arrived issues from the file. The IAL contains the SIN number, a title in two 20 character lines, CODEN, edition, copy number, arrival date and bibliographic levels for the most recent piece checked in, a mark for any claims sent, and the forecast date and bibliographic levels for the next anticipated issue(s). The IAL is used to check in all issues.

3. Arrival Data File (Output)

Is a visual summary of all records presently in the data base in machine readable form. It is useful in surveying a small file such as the one being studied here. Its value, however, will decrease as the file increases in size because of the difficulties involved in using large stacks of printout. It is currently prepared only on demand. Arrangement of the Arrival Data File is by SIN. This list is divided into three columns showing the date on which an issue arrived, the number of days from the base date of its arrival, and the number of days between arrivals. It also shows the CODEN, place of publication, copy number when used, octal code for journals which deliberately omit one or more publishing cycles, increment number, and the number of physical pieces to bind.

4. The File Update Report (Output)

Under normal operating circumstances this is two documents. One will be used to show all holdings added to the file. The second will be used to show all records which have been altered or purged from the file. However, because of the small file now in machine readable form these have been incorporated into one document which is prepared on demand and shows all activity in the file since the last report period.

5. All Overdue Issues More than 2 $\bar{I}_i$ Past Due (Output)

Is a monthly list prepared to assist in the claiming of missing issues. This module was not activated in the present investigation.

IV. FINDINGS OF THIS STUDY

1. An algorithm has been designed and tested which will enable the user to determine if the issues of a periodical fall into a predictable pattern. This pattern is determined from and based upon the historical arrival information captured as each issue was checked in.
2. The universe of serials having a predictable arrival interval is not the subset periodicals but a limited group of periodicals whose number is unknown.
3. The size of the arrival interval is not a function of the distance a journal must travel assuming all other

conditions are equal. This was illustrated by Fig. 1 in which the distance between points along Scales I and III were seen to be equal and unrelated to the distances a given journal must travel. This does suggest, however, a problem for future investigation concerning the relationship between the distance traveled and the probability of a delay occurring.

4. There is no single best expectancy interval which is capable of extrapolation to all periodicals for all libraries. The size of the confidence band was found to vary from journal to journal (See Appendix E) such that any attempt to predict all journals due to arrive within a given work week is totally unrealistic and could lead either to a condition in which many issues had arrived and there was no record to show they were expected; or to one in which the librarian, in his attempts to plan for any contingency, has overloaded the tub file with IAC cards - a condition now existing in many of the "monthly" tub files presently in use. This investigation has demonstrated, however, that it is possible to anticipate a preselected (by the Serials Librarian) percentage of the arrivals by adjusting the size of the expectancy band (95% and 99% were used here). This expectancy band may vary from library to library for the same titles. Preliminary evidence would seem to indicate that it does, but this investigation has no information regarding the behavior of the expectancy band in other libraries. In effect, this means that librarians who batch all expected arrivals into a single period (everything due to arrive in the next month) based solely upon a mean arrival date and/or the publisher's planned frequency of issue have merely created another file. This research indicates quite clearly that each journal has its own expectancy band or period when its issues are in a state of being expected (See Appendix E). Furthermore, each band must be individually determined and recomputed using all the data each time the interval ($\bar{I}$) is recalculated until such time as the interval values begin to center themselves or cluster around a single best value. Not only does each journal have its own expectancy band which is controlled by the history of that journal, but there is no similiarity between the bands for journals having the same planned publication interval. For example, one would have expected monthlies to be fairly uniform in the number of days when they could be expected. That such was not the case is easily verified by comparing the confidence intervals around those journals having a population mean arrival interval of 30 in Appendix E.

The numerical data supporting these findings is arrayed in Appendix E. Here each journal studied is identified by its Serial Identification Number. Those wishing to match titles with appropriate SIN's are referred to Appendix F.

All computations were carried out to the closest whole number. In Appendix E the following variables have been displayed for each title in the sample population:

Col. 1. Serial Identification Number

Col. 2. The expected days per interval. This is the population mean (μ) arrival interval for that journal as derived from the publisher's statement of the journal's planned frequency of issue. For example, a monthly would show 30 days here, a weekly 7 days, a quarterly 91 days etc.

Col. 3. The observed number of days per interval shown here as the sample mean ($\bar{I}_s$) calculated by using all the data.

Col. 4. A sample standard deviation calculated by using all data in the sample.

Col. 5,6,7 and 8. Confidence intervals using the variance computed in Col. 4 above.

Col. 9. A recomputed number of days per interval calculated after 3 iterations through the data during which all intervals in the sample beyond $\pm$ 2 s are thrown out such that $-2s \leqslant \bar{I} \leqslant +2s$. In the course of these iterations a new $\bar{I}$ is derived and a new value for n now called m.

Col. 10,11,12 and 13. Represent the new confidence intervals calculated around a revised $\bar{I}$ and using m with the revised variance.

Col. 14. Is the number (N) of issues checked in through March 10, 1971. The number of intervals, therefore, is N-1 and the degrees of freedom used in the computation is N-2.

V. RECOMMENDATIONS

A. For the Administrator.

1. Those administrators interested in electronic data processing for their serials records, especially those wishing to anticipate the arrival of journal issues have here a model which will enable them to perform this function. However, its operation is contingent upon the availability of a medium to large size computer with random access and the necessary historical arrival data from which statistical inferences about arrival behavior can be made. If such an historical file of information does not now exist, the administrator should begin at once to assemble this data.

2. Any administrator embarking on this type of a program must remember that the methodology used here is statistical in nature and therefore not capable of 100% prediction. Administrators must, therefore, prepare their staffs for the inevitable exception, and assure all concerned that exceptions can be handled without readjusting the entire serials system for what is by definition an occasional occurrance.

3. That any library's currently using as anticipatory mechanisms the planned publication frequency of a serial review their need for and their use of such a file in the light of this investigation's ability to determine individual expectancy bands. In-house tub files can thereby be kept to their minimum size.

B. For Future Research.

This investigation has raised a number of questions which will need to be answered before Serial Departments can hope to achieve their goal of a reasonably efficient completely integrated EDP processing system for periodicals. These questions are as follows:

1. Although anticipating the arrival of a regular periodical whose planned intervals are all equivalent has been solved by this investigation, there still remains the problem of processing a periodical whose arrival intervals are planned and predictable but not equal. These are journals with a non-standard arrival frequency which plan for an irregular arrival pattern by turning themselves off during certain periods of the year.

2. Develop a test which correlates the size of the present interval with the next expected interval such that a long interval, usually followed by a short interval, can be weighted in the calculation of the arithmetic mean.

3. Build from the present data and the expectancy band an algorithm which translates arrival processing into cost/benefit.

4. Determine how or in what way the number of readings affects the level of accuracy of the anticipated arrival interval.

5. No uniformily successful technique for inserting changes into the serial record or for handling the innumerable mutations which serials undergo was developed. Changes in arrival patterns, frequency, or in the numbering of the bibliographic levels proved extremely difficult to integrate into the system. Indeed, such changes can invalidate an operating arrival code, since they change the size of the interval or the increment number making it necessary to again allow enough time to pass in order to obtain a valid sample. Techniques should be developed which will enable the serials librarian to handle change with a minimum of readjustment.

6. To investigate the relationship(s) between the

probability that a journal will be delayed in transit as this delay is affected by the distance that journal must travel from origin to destination. Does the probability of a delay arising increase directly as the distance the item must travel, and if so in what way? Of what factors is delay a function and how can these be quantified for measurement and study?

BIBLIOGRAPHY FOR REVIEW OF LITERATURE

1. Bishop, David, A.L. Milner and Fred Roper. "Publication Patterns of Scientific Serials." Am Doc 16(2):113-121. April, 1965.

2. Roper, Fred W. "A Computer-based Serials Control System for a Large Biomedical Library." Am Doc 19 (2):151-157. April, 1968.

3. Eyman, Eleanor G. et al. "Periodicals Automation At Miami Dade Junior College." Lib Res & Tech Services 10(3):341-361. Summer, 1966.

4. McCann, Anne "Applications of Machines to Library Techniques: Periodicals." Am Doc. 12(4):260-265. October, 1961.

5. Laucus, Carol A. & Susan J. Russell. Preliminary Report On the Serials Automation Project at Baker Library. Mimeo Report. January, 1966.

6. Vdovin, G. et al. "Computer Processing of Serial Records." Lib Res & Tech Services. 7(1):71-80. Winter, 1963.

7. Stewart, Bruce W. "Data Processing In the Texas A & M University Library," p. 167-194, in Proceedings of the 1966 Clinic On Library Applications of Data Processing. Champaign, Ill., University of Illinois, Graduate School of Library Science, 1966.

8. Srygley, Ted F. "Serials Record Instructions For A Computerized Serial System." Lib Res & Tech Services. 8(8):248-256. Summer, 1964.

9. Pizer, I.H., D.R. Franz & E. Brodman. "Mechanization of Library Procedures In the Medium-sized Medical Library: I. The Serial Record." Bull Med Libr Assoc. 51:313-338. July, 1963.

10. Lebowitz, A.I. "The AEC Library Serial Record: A Study in Library Mechanization." Spec Lib. 58(3):154-159. March, 1967.

11. Crismond, Linda F. & S.F. Fatzer. "Automated Serials Check-in and Binding Procedures at the San Francisco Public Library," p. 13-20, in Cooperative Information Societies, Proceedings of the American Society For Information Science, vol. 6. Westport, Conn., Greenwood Pub. Corp., 1969. A report of this project was also carried in the LJ for Oct. 15, 1969.

12. Enright, B.J. & D.G. Hanson. "An Experimental Periodicals Checking List." Program: News of Computers In British University Libraries No. 7, Oct., 1967 p. 4-11.

13. Fayollat, Jim: Luck, Don. Summary Report Of the UCLA Biomedical Library Control System For Serials. 1967 October. University of California, Los Angeles. 21 p. CFSTI: PB-179-756.

14. Fielding, Derek. "American Automation Updated." Lib J. 94(15):2881-2885. Sept. 1, 1969.

15. Grosch, Audrey N. "University of Minnesota Bio-Medical Library Serials System." Spec Lib 60(6):349-360. July/August 1969. Also published by ERIC as ED 021577.

16. Livingston, F.G. "Semiautomated Journal Check-in and Binding System." Bull Med Lib Assoc. 55:316-320. July 1967.

17. Strom, Karen D. "Software Design For Bio-Medical Library Serials Control System," p. 267-275 in Proceedings of the American Society For Information Science Annual Meeting Vol. 5., Information Transfer. N.Y. Greenwood Publishing Corp., 1968.

18. Kozlow, Robert D. A Synopsis of An Automated Library Serials System Plus Instructions For Coding. Mimeo Report to the National Science Foundation For Grants 77 and 302. February, 1965.

19. Wilkinson, W.A. "A System For Machine Assisted Serials Control." Spec Lib 58:149-153. March, 1967.

20. MacDonald, R.W. "Serials Systems," p. 43-48, in Automation In Libraries. Papers presented at the C.A.C.U.L. Workshop on Library Automation. Canadian Association of College and University Libraries, 1967.

21. Newton, Gerald D. Statistical Report of Library Serials Mechanization For California, Oregon, and Washington. Presented at the Oregon Library Mechanization Workshop, University of Oregon, Eugene, Oregon, June 10-15, 1968.

22. Paulson, Peter J. "State Library Begins Test of Automated Serials System." Bookmark 27(5):192. February, 1968.

23. Computer Usage Co. Specification For An Automated Library System Prepared For University of California at Santa Cruz. Mimeo Report. April, 1965.

24. Kenney, Brigitte L. & Patricia M. Hutchins. "First Steps Toward An Automated Serials System." The Reminder 25 (3): 1-38. May, 1968.

25. Payne, Ladye M., L. Small & R.T. Divett. "Mechanization In A New Medical School Library: II. Serials and Circulation." Bull Med Lib Assoc. 54(4):337-350. October, 1966.

26. United States of America Standards Institute. Committee Z 39 on Standardization In the Field of Library Work, Documentation, and Related Publishing Practices. USA Standard For Periodicals: Format and Arrangement. New York, The Institute, 1967.

27. Report On Serials Computer Project, University Library and UCSD Computer Center. Mimeo Report. University of California, San Diego, LaJolla, California. 1962.

28. Clyde, Eric. "Progress In the Automation of Serials At the National Science Library," p. 64-75, in Automation In Libraries. Papers presented at the C.A.C.U.L. Workshop on Library Automation. Canadian Association of College and University Libraries, 1967.

29. Brown, Jack E. & Wolters, Peter. "Mechanized Listing of Serials At the National Research Council Library." Canadian Library 19:420-426. May, 1963.

30. Curran, Ann T. & Avram, H.D. Identification of Data Elements In Bibliographic Records. Final Report of the Special Project on Data Elements For the Subcommittee on Machine Input Records of the Sectional Committee on Library Work and Documentation (Z-39) of the United States of American Standards Institute. 1967.

31. Fayollat, James & D. Luck. "Computer Based Serials Control System, Biomedical Library, UCLA." Am Doc 20(4):385. October, 1969.

32. Sherman, Don and Ralph Shoffner. California State Library: Processing Center Design and Specifications. University of California, Los Angeles, Institute of Library Research, April, 1969. Appendix II by Jorge Hinojosa, "Considerations on Statistical Methods For Arrival Prediction and Claiming of Serials."

33. Bosseau, Don L. "The University of California at San Diego Serials System - Revisited." Program 4(1):1-29. January, 1970.

34. Verity, John B. & Elizabeth L. Crocker. "A Computer-Based System For Serial Records At Lawrence Radiation Laboratory." Jour Am Soc Inf Science 21(4):247-253. July-August, 1970.

35. Lemkau, Henry L. & J.R. Straub, "The Design of the Automated Serials Accession System At the Library of the Mount Sinai School of Medicine of the City University of New York." Bull Med Libr Assoc. 58(2):163-172 April, 1970.

36. Kuentzel, L.E. ed. CODEN For Periodical Titles. 2nd edition Philadelphia, Pa., American Society For Testing And Materials, 1966. 2 vols. Supplements were published in 1968 and 1969.

37. Newton, Gerald D. Serials - Stage 2. Mimeo Report. Prepared by the Systems And Automation Office of the University Library. Library Systems Document SER70-3. University of California, Davis. March, 1970.

38. Snedecor, George W. & William G. Cochran, Statistical Methods. 6th ed. Ames, Iowa, The Iowa State University Press, 1967. 593 p.

APPENDIX A

DATA ELEMENT DICTIONARY

Arrival Code Continuum - Is a graphic representation of the relationships between the arrival interval (I_i), the arrival event (E_i), the arrival date (T_i) and the physical piece (P_i).

Arrival Date (T)- Is that point in time when a journal issue makes its appearance in a library. It is a subset of the arrival event (E) and acts as a boundary for the arrival interval (I). The arrival date is always expressed as the number of days from the base date (q.v.), but it can also be expressed as the month, day and year when the piece appears. See also Arrival Event.

Arrival Event (E) - Occurs whenever a physical piece arrives in the library and is a function of both the arrival date (T_i), expressed here as the number of days from the base date, together with the bibliographic coordinates used to identify the arriving physical piece (P_i). The arrival event is expressed as $E_i = f(T_i, P_i)$.

Arrival Frequency - See Frequency of Issue.

Arrival Interval (I) - Is the number of 24 hour periods which have elapsed between the appearance of a journal's issues in any given library. It is bounded by two arrival events (E) and expressed by the equation: $I_i = T_{i+1} - T_i$ where T is the number of days from the base date.

Arrival Pattern - See Frequency of Issue.

Base Date - Is an arbitrarily chosen point in time (for purposes of this investigation January 1, 1900) from which all arrival dates are calculated. Because the number of days is measured continuously from the base date, determining the size of each past arrival interval becomes a simple matter of subtraction. Use of a base date has eliminated the problems incurred in handling leap years and in making the transition from December 31 to January 1 on the computer. The base date is permitted to vary from serial to serial and from library to library.

Bibliographic Coordinates - Are those terms and their alphanumeric coefficients found on the physical piece in hand which, when combined, serve to precisely identify and make unique that physical piece. They are usually

arranged in a hierarchy of bibliographic levels (q.v.). For example: Series C, Volume 24, Part 5.

Bibliographic Level - Is the term used when referring to one strata of the bibliographic hierarchy alluded to in the Curran and Avram study (30). See Table 1. These elements (occasionally there is only one) normally appear on the piece itself and are used to express the relationship of the piece in hand to a larger or smaller bibliographic unit as well as to show the relationship of the piece in hand to the pieces which came immediately before and after it. For purposes of this research four bibliographic levels are postulated.

Claiming - Is the library activity in which an "overdue" issue is requested from the publisher or agency likely to have a copy.

CODEN - Is a standard 5 character code (alpha/numerics) assigned to journal titles by the ASTM.

Confidence Interval - See Expectancy Interval

Cover Date - Is the date which appears on the cover of the issue. May be a month, day, year, season, or any combination of these. Used occasionally to identify the piece when there is no other bibliographic identification present.

Cross Over Interval - See Negative Interval

Date - See Date of Issue, Cover Date, Date of Arrival, Date of Publication, Expected Date.

Date of Arrival - See Arrival Date

Date of Issue - Is the date when issues of a journal are mailed.

Date of Publication - See Cover Date

Expectancy Band - See Expectancy Interval

Expectancy Interval - Is the period (also called a confidence interval) during which an issue of a journal is in the state of being expected. We may say, for example, that journal XYZ is expected to arrive every thirty days as determined by the arithmetic mean of previous intervals, and that it will make its appearance within $\pm$ 10 days of the thirtieth day. This means that we can anticipate arrival of the journal every thirty days and that its actual arrival should take place between the twentieth and the fortieth day. The

expectancy interval or band in this case is 20 days. The expectancy interval in this investigation is another name for the confidence interval used by statisticians.

Expected Date - Is the anticipated date of the next expected issue. Can be expressed in terms of the number of days from the base date, but its preferred form is the month, day, and year on which the next issue is expected to arrive.

Frequency - Is the number or term which expresses the periodicy of a journal. Can be expressed either as the Frequency of Issue (q.v.) assigned by the publisher or by the Arrival Date (q.v.) which marks its actual appearance in a given library.

Frequency of Arrival - See Frequency of Issue

Frequency of Issue - Is a statement by the publisher or editor usually found on the inside of the front cover, which tells how often he intends to publish his journal. It can be a generic expression or a number which the journal uses to designate the planned regularity with which it will be published in the 12 month period from January through December. For example, "daily;" "weekly;" "fortnightly;" "monthly;" "Nine Times A Year;" "in January, April, July, and October." It will occasionally appear as a word in the title itself.

Increment Number - Is that constant which designates the number of parts required at that bibliographic level in order to increment by one the next higher bibliographic level.

Interval - See Arrival Interval

Issue - A single physical piece such as a numbered or dated copy of a periodical or serial publication. In this investigation the term designates a physical item ready to be checked in and is used synonymously with the term piece.

Issue Arrival Card (IAC) - Is one of the tab cards prepared each week and sent to the library with the Issue Arrival List (q.v.). Each card represents an issue expected. No duplicate cards are made for issues which did not arrive in the last cycle.

Issue Arrival List (IAL) - Is the weekly report showing all issues scheduled to arrive in the coming week as well as those which have not arrived in the past four weeks.

Issue Number - Is that number, usually found on the cover of a physical piece, that uniquely identifies the particular piece in hand. Often it will be combined with another number at another bibliographic level, but it is sometimes found alone.

Negative Interval - Is an interval whose value is a negative quantity. This condition results whenever one or more issues appear out of their customary temporal/bibliographic sequence and results in one interval being nested within another. This phenomenon is treated, for purposes of deriving the arithmetic mean, as a negative quantity and summed algebraically with the values for all other intervals. It normally occurs when one issue is very late in coming and other issues continue to arrive in the meantime in their correct temporal/bibliographic sequence.

Periodical - A publication issued in successive parts, usually at regular intervals, and, as a rule intended to be continued indefinitely (26).

Piece - See Issue

Reverse Interval - See Negative Interval

Serial Identification Number (SIN) - Is a unique 10 digit number assigned to each journal for purposes of arranging, addressing, and accessing the file. These numbers are assigned sequentially at intervals of 1000 at the time a journal is inserted into the file. The order in which the numbers are assigned is determined by the ALA filing rules.

Spare Parts - Is a collective term used for all extra parts, sections, issues, numbers etc. which come with a serial subscription and whose arrival cannot be anticipated. Includes such things as directories, indices, contents pages, supplements etc. No attempt was made in this investigation to anticipate their arrival.

State of Expectancy - A state or condition assumed by the journal when its arrival cycle has reached the journal's expectancy interval (q.v.)

Zero Interval - Is an arrival interval bounded by two arrival events which are equal in time but not equal in bibliographic value. For example, issues 3 and 4 (2 pieces or one piece with 2 numbers) come to the library on the same day resulting in an interval with I = 0.

APPENDIX B

DATA COLLECTION FORM

OPERATION CODES

_____Add

_____Delete

_____Replace

Date_____

Prepared By_____

Record Type 05

Record Continuation_____

TITLE _____

_____

SIN _____ CODEN _____ CALL NUMBER

EDITION _____ COP # _____

PUBLISHED IN _____

START DATA COLLECTION WITH _____

END DATA COLLECTION WITH _____

PLANNED FREQUENCY _____ TIMES PER YEAR

DATES CLAIMED _____ | _____ | _____ | _____

NUMBER OF PIECES TO BIND _____

GENERIC NAMES FOR BIBLIOGRAPHIC LEVELS

A _____

B _____

C _____

D _____

INCREMENT NUMBERS

_____

_____

_____

_____ ISSUE NUMBERING IS CONTINUOUS

NAMES AND ARRIVAL DATES OF SPARE PARTS

_____

_____

_____

_____

NOTES:

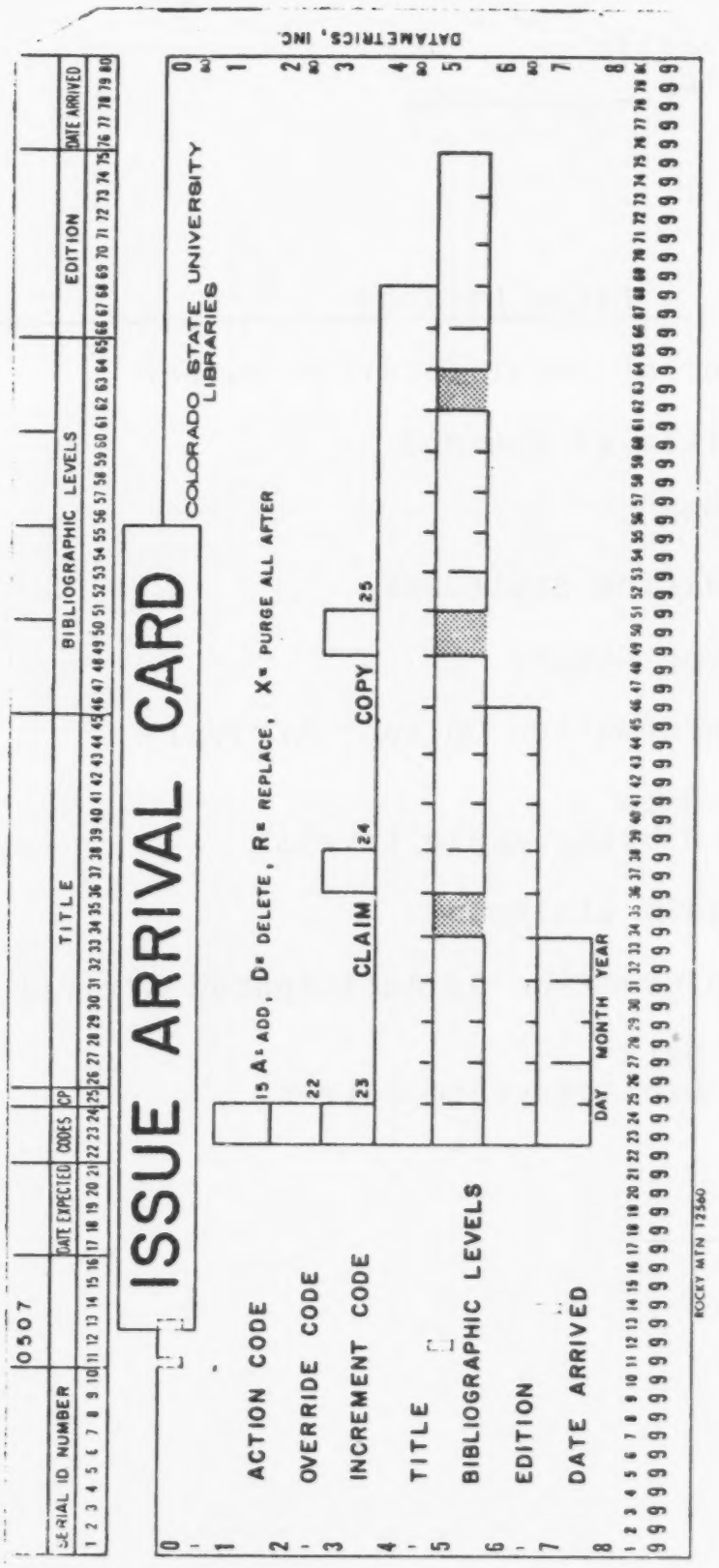
APPENDIX C

Format For the Issue Arrival List (IAL)

Issue Arrival List
Colorado State University
For the Week Beginning _____
Page _____

Field #	Field Defined
1.	Serial Identification Number
2.	Title of Journal
3.	CODEN
4.	Edition Statement
5.	Copy Number
6.	Information On Last Arrival
6a.	Date
6b.	Bibliographic Levels
7.	Claim Statement
8.	Information on Anticipated Arrival
8a.	Date
8b.	Bibliographic Levels

Appendix D


0507
SERIAL ID NUMBER
DATE EXPECTED
CODES
CP
TITLE
BIBLIOGRAPHIC LEVELS
EDITION
DATE ARRIVED
CARD
ISSUE ARRIVAL
COLORADO STATE UNIVERSITY LIBRARIES
DATAMETRICS, INC.
A= ADD, D= DELETE, R= REPLACE, X= PURGE ALL AFTER
ACTION CODE
OVERRIDE CODE
INCREMENT CODE
TITLE
BIBLIOGRAPHIC LEVELS
EDITION
DATE ARRIVED
CLAIM
COPY
25
24
23
22
15
DAY MONTH YEAR
ROCKY MTN 12560

APPENDIX E

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		ITER D/I	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		N
0000018000	30.	30.	16.	-3.	63.	-14.	74.	24.	6.	43.	-.	49.	26.
0000019000	30.	31.	18.	-7.	67.	-20.	80.	28.	6.	51.	-3.	60.	25.
0000022000	61.	61.	11.	37.	85.	29.	93.	60.	50.	71.	46.	75.	25.
0000024000	30.	30.	4.	22.	38.	20.	40.	30.	23.	38.	20.	41.	26.
0000040000	30.	30.	10.	9.	51.	1.	59.	29.	13.	44.	8.	50.	25.
0000041000	91.	94.	52.	-19.	201.	-60.	242.	94.	-17.	205.	-58.	247.	20.
0000050000	30.	30.	9.	11.	49.	4.	56.	29.	14.	44.	8.	49.	31.
0000095000	91.	91.	29.	30.	152.	9.	173.	92.	79.	104.	75.	109.	26.
0000096000	91.	91.	24.	40.	142.	22.	160.	90.	58.	122.	47.	134.	25.
0000099000	30.	35.	18.	-9.	69.	-23.	83.	34.	8.	59.	-2.	69.	23.
0000102000	30.	31.	10.	8.	52.	-1.	61.	34.	18.	50.	12.	56.	19.
0000113000	91.	89.	114.	-156.	338.	-248.	430.	82.	-6.	170.	-41.	205.	19.
0000116000	36.	37.	16.	-4.	64.	-16.	76.	39.	13.	64.	4.	74.	27.
0000118000	4630.	44.	47.	-71.	131.	-109.	169.	48.	-13.	109.	-36.	133.	19.
0000126000	91.	99.	68.	-56.	238.	-111.	293.	88.	-26.	203.	-71.	247.	19.
0000127000	30.	31.	13.	4.	56.	-6.	66.	32.	8.	56.	-1.	65.	25.
0000134000	91.	95.	49.	-15.	197.	-54.	236.	95.	-13.	202.	-53.	242.	19.
0000135000	91.	103.	30.	26.	156.	1.	181.	99.	43.	155.	21.	177.	18.
0000144000	30.	35.	21.	-13.	73.	-28.	88.	35.	-8.	78.	-24.	94.	30.
0000146000	30.	29.	16.	-3.	63.	-15.	75.	27.	3.	52.	-5.	60.	25.
0000180000	30.	34.	19.	-11.	71.	-26.	86.	32.	5.	59.	-6.	69.	24.
0000200000	61.	63.	21.	15.	107.	-2.	124.	61.	34.	89.	24.	99.	18.
0000210000	30.	30.	8.	13.	47.	7.	53.	30.	17.	43.	13.	48.	26.
0000211000	30.	30.	30.	-29.	89.	-48.	108.	30.	18.	42.	15.	46.	86.
0000212000	91.	92.	36.	15.	167.	-12.	194.	93.	54.	132.	40.	147.	23.
0000214000	91.	91.	12.	66.	116.	57.	125.	93.	77.	108.	71.	114.	20.
0000217000	30.	32.	8.	13.	47.	7.	53.	31.	25.	36.	23.	38.	25.
0000221000	91.	93.	28.	29.	153.	4.	178.	93.	30.	156.	4.	182.	13.
0000341000	30.	31.	7.	16.	44.	12.	48.	29.	18.	41.	15.	44.	38.
0000345000	30.	31.	16.	-3.	63.	-15.	75.	31.	-2.	64.	-14.	76.	23.
0000346000	91.	91.	36.	6.	176.	-30.	212.	91.	4.	177.	-33.	214.	11.
0000346100	30.	34.	12.	5.	55.	-5.	65.	31.	14.	47.	7.	54.	19.
0000347000	30.	30.	6.	17.	43.	13.	47.	30.	17.	43.	13.	48.	27.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		ITER D/I	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		N
0000365000	91.	88.	32.	24.	158.	-1.	183.	91.	30.	152.	8.	174.	23.
0000369000	91.	102.	29.	27.	155.	1.	181.	98.	43.	152.	20.	175.	14.
0000383000	30.	30.	18.	-7.	67.	-21.	81.	32.	1.	63.	-10.	75.	24.
0000386000	91.	92.	29.	27.	155.	2.	180.	92.	28.	156.	3.	182.	16.
0000387000	30.	32.	8.	13.	47.	7.	53.	31.	18.	45.	13.	49.	25.
0000392000	30.	46.	49.	-48.	170.	-91.	213.	32.	12.	53.	3.	62.	14.
0000394000	30.	31.	7.	15.	45.	10.	50.	30.	17.	44.	12.	48.	22.
0000398000	30.	31.	84.	-147.	207.	-211.	271.	29.	-1.	58.	-12.	69.	23.
0000418000	30.	31.	20.	-12.	72.	-27.	87.	28.	1.	55.	-9.	64.	24.
0000421000	30.	30.	60.	-98.	158.	-144.	204.	30.	-3.	63.	-15.	76.	23.
0000431000	61.	60.	20.	18.	104.	3.	119.	58.	34.	81.	25.	90.	19.
0000436100	30.	30.	21.	-15.	75.	-31.	91.	30.	14.	45.	9.	51.	24.
0000535000	30.	35.	98.	-165.	225.	-227.	287.	33.	6.	60.	-3.	69.	36.
0000536000	30.	28.	26.	-25.	85.	-44.	104.	25.	-23.	73.	-40.	90.	26.
0000547000	91.	92.	33.	20.	162.	-6.	188.	88.	41.	134.	23.	152.	20.
0000548000	91.	106.	43.	30.	214.	-4.	248.	106.	14.	199.	-20.	233.	20.
0000554000	61.	61.	10.	40.	82.	33.	89.	60.	42.	77.	35.	84.	19.
0000568000	61.	61.	29.	-.	122.	-22.	144.	57.	3.	112.	-17.	132.	24.
0000571000	91.	89.	24.	39.	143.	20.	162.	89.	37.	141.	17.	161.	17.
0000573000	91.	92.	28.	32.	150.	10.	172.	92.	33.	152.	11.	174.	20.
0000600010	30.	30.	11.	6.	54.	-2.	62.	31.	22.	39.	19.	42.	26.
0000613000	30.	30.	5.	21.	39.	18.	42.	31.	23.	39.	21.	41.	38.
0000615010	30.	32.	21.	-16.	76.	-32.	92.	32.	19.	45.	13.	50.	20.
0000618000	61.	65.	31.	-5.	127.	-29.	151.	67.	24.	109.	8.	125.	21.
0000621000	30.	30.	27.	-26.	86.	-46.	106.	30.	16.	43.	12.	48.	26.
0000640000	30.	30.	15.	-2.	62.	-14.	74.	30.	12.	48.	6.	54.	25.
0000641000	30.	28.	14.	1.	59.	-9.	69.	28.	13.	43.	8.	49.	24.
0000646000	15.	15.	5.	5.	25.	1.	29.	14.	9.	18.	7.	20.	28.
0000668000	61.	61.	11.	35.	87.	25.	97.	59.	39.	78.	30.	87.	12.
0000678000	30.	31.	5.	20.	40.	16.	44.	31.	21.	41.	17.	44.	26.
0000681000	30.	31.	7.	15.	45.	10.	50.	30.	18.	42.	14.	46.	26.
0000686000	30.	31.	6.	18.	42.	13.	47.	29.	20.	39.	17.	42.	26.
0000724000	91.	91.	19.	53.	129.	41.	141.	90.	58.	122.	48.	132.	40.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		ITER D/I	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		N
0000729000	91.	92.	39.	14.	168.	-11.	193.	92.	60.	125.	50.	135.	41.
0000737000	30.	30.	8.	14.	46.	9.	51.	30.	17.	43.	13.	47.	121.
0000740000	30.	30.	7.	15.	45.	11.	49.	31.	18.	44.	14.	48.	38.
0000752000	30.	31.	17.	-5.	65.	-18.	78.	31.	-4.	67.	-17.	80.	25.
0000765000	30.	30.	7.	16.	44.	11.	49.	29.	22.	36.	20.	39.	26.
0000768000	91.	90.	20.	48.	134.	31.	151.	90.	47.	133.	30.	150.	16.
0000777000	91.	102.	27.	34.	148.	12.	170.	102.	44.	160.	23.	182.	19.
0000813000	91.	87.	29.	31.	151.	9.	173.	89.	62.	116.	52.	126.	25.
0000813250	91.	92.	73.	-62.	244.	-117.	299.	88.	62.	114.	52.	123.	25.
0000816000	91.	88.	27.	43.	139.	25.	157.	93.	70.	115.	61.	124.	19.
0000818000	30.	30.	5.	11.	49.	5.	55.	30.	15.	45.	9.	51.	25.
0000820000	91.	93.	38.	21.	161.	-7.	189.	78.	48.	107.	35.	120.	16.
0000821000	30.	30.	15.	-1.	61.	-11.	71.	29.	9.	48.	2.	56.	26.
0000822000	30.	31.	9.	21.	39.	18.	42.	31.	24.	37.	22.	39.	25.
0000823000	91.	91.	17.	55.	127.	42.	140.	92.	73.	111.	66.	117.	25.
0000824000	30.	31.	8.	13.	47.	7.	53.	31.	14.	48.	8.	54.	25.
0000826000	61.	63.	25.	7.	115.	-12.	134.	60.	12.	108.	-5.	125.	24.
0000832000	30.	31.	7.	16.	44.	11.	49.	30.	20.	40.	16.	44.	25.
0000834000	61.	61.	25.	8.	114.	-8.	130.	62.	33.	92.	22.	102.	37.
0000835000	30.	31.	6.	18.	42.	14.	46.	30.	23.	37.	21.	39.	109.
0000836010	15.	15.	5.	5.	25.	2.	28.	15.	6.	23.	3.	26.	27.
0000839000	30.	31.	8.	13.	47.	8.	52.	30.	16.	44.	12.	48.	37.
0000846000	61.	63.	23.	10.	112.	-10.	132.	63.	12.	114.	-8.	134.	16.
0000848000	61.	59.	20.	20.	102.	6.	116.	56.	33.	79.	25.	87.	31.
0000849000	61.	58.	19.	19.	103.	3.	119.	57.	42.	72.	35.	78.	18.
0000850000	30.	30.	14.	2.	58.	-6.	66.	28.	5.	51.	-2.	58.	37.
0000852000	30.	32.	9.	12.	48.	5.	55.	30.	18.	42.	14.	47.	25.
0000853000	91.	92.	36.	14.	168.	-14.	196.	86.	40.	132.	23.	149.	24.
0000856000	30.	30.	26.	-24.	84.	-43.	103.	30.	21.	40.	18.	43.	25.
0000858000	30.	31.	7.	17.	43.	12.	48.	31.	17.	44.	13.	49.	37.
0000860000	61.	62.	40.	-23.	145.	-53.	175.	63.	32.	94.	21.	105.	27.
0000861000	30.	31.	13.	3.	57.	-5.	65.	30.	15.	45.	9.	50.	37.
0000864000	61.	59.	13.	37.	85.	28.	94.	59.	35.	83.	26.	92.	19.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		99%		ITER D/I	CONFIDENCE INTERVALS 95%		99%		N
0000867000	30.	31.	11.	8.	52.	-.	60.	29.	11.	47.	4.	53.	25.
0000887000	15.	14.	10.	-7.	37.	-14.	44.	14.	2.	25.	-2.	29.	29.
0000922000	7.	8.	6.	-6.	20.	-10.	24.	8.	.	15.	-2.	17.	57.
0000949000	61.	61.	24.	8.	114.	-12.	134.	61.	8.	115.	-12.	135.	18.
0000957000	30.	36.	51.	-72.	132.	-104.	164.	30.	14.	45.	9.	51.	36.
0000998000	30.	30.	10.	11.	49.	5.	55.	27.	15.	39.	11.	44.	38.
0001010000	30.	30.	8.	14.	46.	8.	52.	30.	13.	46.	8.	52.	25.
0001013000	30.	31.	4.	21.	39.	18.	42.	31.	21.	40.	18.	43.	26.
0001019000	91.	91.	26.	35.	147.	15.	167.	91.	35.	147.	15.	167.	21.
0001043000	30.	30.	19.	-8.	68.	-20.	80.	29.	14.	45.	9.	50.	38.
0001054000	91.	93.	10.	69.	113.	61.	121.	91.	72.	110.	65.	118.	16.
0001110000	61.	62.	21.	17.	105.	1.	121.	64.	38.	90.	28.	99.	30.
0001116000	91.	92.	17.	55.	127.	42.	140.	92.	56.	128.	43.	141.	24.
0001150000	30.	31.	5.	19.	41.	16.	44.	29.	22.	37.	19.	39.	25.
0001166000	61.	62.	13.	32.	90.	21.	101.	62.	50.	74.	46.	79.	16.
0001173000	30.	34.	24.	-17.	77.	-32.	92.	33.	7.	60.	-3.	69.	36.
0001175000	7.	7.	4.	-2.	16.	-5.	19.	6.	2.	11.	1.	12.	60.
0001195000	61.	59.	14.	32.	90.	22.	100.	61.	44.	78.	37.	85.	25.
0001263000	91.	89.	103.	-135.	317.	-220.	402.	91.	39.	142.	19.	162.	17.
0001264000	61.	63.	9.	42.	80.	35.	87.	63.	44.	82.	37.	89.	24.
0001272000	91.	98.	46.	-9.	191.	-46.	228.	98.	-3.	200.	-42.	239.	19.
0001335000	91.	101.	37.	12.	170.	-16.	198.	96.	34.	158.	11.	181.	21.
0001340000	91.	91.	35.	10.	172.	-25.	207.	91.	9.	174.	-27.	210.	11.
0001378000	91.	92.	171.	-271.	453.	-400.	582.	91.	57.	125.	44.	138.	24.
0001485000	91.	92.	28.	30.	152.	8.	174.	92.	31.	153.	8.	176.	20.
0001499000	91.	91.	14.	60.	122.	49.	133.	91.	60.	121.	48.	133.	20.
0001615000	30.	32.	22.	-13.	73.	-27.	87.	30.	10.	50.	3.	58.	36.
0001622000	91.	92.	10.	70.	112.	62.	120.	89.	75.	103.	70.	109.	17.
0001648000	61.	62.	8.	43.	79.	36.	86.	62.	44.	80.	36.	88.	12.
0001665000	30.	29.	10.	10.	50.	4.	56.	29.	11.	47.	6.	53.	40.
0001678000	30.	30.	5.	19.	41.	16.	44.	29.	21.	38.	18.	40.	33.
0001682000	30.	40.	42.	-59.	119.	-92.	152.	30.	18.	43.	13.	47.	20.
0001773000	30.	31.	5.	20.	40.	17.	43.	29.	24.	35.	21.	37.	26.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		99%		ITER D/I	CONFIDENCE INTERVALS 95%		99%		N
0001777000	91.	93.	14.	60.	122.	48.	134.	93.	63.	124.	50.	136.	16.
0001782000	7.	7.	3.	.	14.	-2.	16.	7.	2.	11.	.	13.	33.
0001802000	91.	96.	31.	22.	160.	-5.	187.	91.	35.	147.	13.	169.	16.
0001829000	61.	61.	12.	36.	86.	26.	96.	57.	40.	75.	33.	82.	18.
0001880000	30.	31.	27.	-24.	84.	-41.	101.	31.	18.	44.	13.	49.	33.
0001881000	30.	29.	11.	8.	52.	1.	59.	29.	16.	42.	11.	46.	34.
0001996000	61.	62.	12.	37.	85.	28.	94.	63.	45.	80.	39.	86.	27.
0002017000	91.	89.	19.	49.	133.	33.	149.	92.	60.	125.	47.	138.	16.
0002019000	30.	31.	6.	17.	43.	13.	47.	30.	22.	38.	19.	40.	26.
0002196000	91.	92.	26.	37.	145.	18.	164.	92.	72.	111.	65.	118.	28.
0002206000	91.	92.	19.	50.	132.	35.	147.	92.	51.	133.	37.	148.	24.
0002207000	30.	33.	64.	-97.	157.	-137.	197.	34.	-11.	79.	-27.	94.	36.
0002217000	61.	64.	27.	4.	118.	-16.	138.	58.	17.	99.	2.	114.	24.
0002220000	122.	120.	17.	85.	159.	71.	173.	120.	83.	158.	68.	173.	18.
0002221000	183.	188.	72.	202.	528.	137.	593.	170.	83.	257.	46.	294.	13.
0002222000	91.	91.	19.	50.	132.	35.	147.	91.	50.	132.	34.	147.	20.
0002232000	30.	31.	14.	2.	58.	-7.	67.	30.	13.	47.	8.	52.	33.
0002233000	91.	91.	25.	39.	143.	20.	162.	89.	42.	136.	25.	152.	24.
0002234000	91.	92.	38.	10.	172.	-18.	200.	90.	38.	143.	19.	162.	27.
0002236000	30.	39.	26.	-22.	82.	-39.	99.	33.	-4.	71.	-18.	84.	32.
0002237000	61.	57.	29.	-2.	124.	-26.	148.	57.	-7.	120.	-31.	145.	17.
0002239000	122.	115.	33.	50.	194.	21.	223.	124.	86.	161.	70.	177.	15.
0002240000	7.	8.	57.	-105.	119.	-141.	155.	7.	-14.	29.	-21.	36.	54.
0002253000	91.	88.	24.	37.	145.	15.	167.	88.	33.	143.	10.	165.	13.
0002260000	30.	33.	15.	1.	59.	-8.	68.	31.	16.	46.	11.	51.	48.
0002265000	7.	7.	1.	4.	10.	3.	11.	7.	5.	8.	5.	9.	40.
0002276000	30.	33.	15.	-3.	63.	-15.	75.	33.	-1.	67.	-13.	79.	22.
0002283000	91.	86.	34.	14.	168.	-18.	200.	86.	8.	165.	-25.	197.	12.
0002314000	30.	32.	22.	-14.	74.	-28.	88.	30.	20.	40.	17.	43.	49.
0002329000	91.	121.	75.	-42.	286.	-104.	348.	107.	41.	172.	13.	201.	17.
0002331000	91.	100.	23.	42.	140.	24.	158.	97.	53.	140.	37.	157.	19.
0002332000	91.	87.	24.	36.	146.	14.	168.	93.	61.	126.	47.	140.	12.
0002333000	91.	92.	29.	30.	152.	8.	174.	92.	31.	153.	9.	175.	24.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		ITER D/I	CONFIDENCE INTERVALS 95%		CONFIDENCE INTERVALS 99%		N
0002343000	30.	30.	18.	-6.	66.	-17.	77.	35.	10.	59.	2.	67.	36.
0002357000	30.	30.	6.	18.	42.	14.	46.	30.	19.	42.	15.	46.	30.
0002361000	30.	31.	52.	-73.	133.	-106.	166.	30.	12.	48.	6.	54.	50.
0002368000	91.	90.	27.	34.	148.	14.	168.	93.	43.	143.	25.	161.	24.
0002372000	30.	31.	40.	-49.	109.	-74.	134.	31.	17.	44.	12.	49.	41.
0002374000	30.	31.	22.	-17.	77.	-34.	94.	31.	21.	41.	17.	44.	25.
0002378000	7.	7.	3.	2.	12.	.	14.	7.	2.	12.	1.	13.	60.
0002672000	30.	30.	10.	11.	49.	5.	55.	32.	18.	45.	14.	49.	50.
0002675000	30.	30.	15.	1.	59.	-8.	68.	29.	6.	52.	-2.	59.	50.
0002681000	1.	0.	407.	-872.	874.	-1194.	1196.	82.	4.	159.	-25.	188.	20.
0002702000	61.	62.	13.	35.	87.	27.	95.	62.	43.	80.	37.	86.	53.
0002712000	30.	31.	12.	6.	54.	-2.	62.	29.	14.	45.	9.	49.	48.
0002713000	91.	92.	24.	41.	141.	23.	159.	91.	66.	115.	57.	124.	28.
0002926000	30.	31.	11.	8.	52.	1.	59.	31.	13.	49.	8.	55.	36.
0003103000	91.	90.	19.	51.	131.	36.	146.	90.	49.	130.	34.	145.	25.
0003105000	22[illegible].	91.	32.	23.	159.	-1.	183.	91.	23.	159.	-2.	184.	20.
0003108000	30.	31.	12.	5.	55.	-2.	62.	30.	18.	41.	14.	45.	51.
0003799000	61.	76.	39.	-21.	143.	-51.	173.	88.	30.	146.	8.	169.	23.
0003829000	30.	41.	28.	-26.	86.	-44.	104.	32.	5.	59.	-4.	67.	50.
0003916000	7[illegible].	18.	18.	-20.	50.	-31.	61.	18.	.	35.	-5.	40.	71.
0003997000	30.	31.	15.	0.	60.	-9.	69.	33.	13.	52.	7.	58.	72.
0004099000	46[illegible].	45.	12.	36.	86.	28.	94.	44.	21.	67.	13.	76.	32.
0004194000	30.	33.	16.	-1.	61.	-11.	71.	29.	7.	52.	-1.	59.	44.
0004267000	7.	7.	2.	3.	11.	1.	13.	7.	5.	9.	4.	9.	60.
0004284000	61.	65.	18.	23.	99.	10.	112.	65.	28.	103.	14.	116.	21.
0004293000	30.	38.	25.	-19.	79.	-34.	94.	28.	5.	51.	-2.	58.	41.
0004341000	30.	30.	6.	18.	42.	14.	46.	31.	22.	39.	20.	41.	75.
0004348000	91.	91.	22.	43.	139.	26.	156.	92.	66.	117.	57.	127.	21.
0004599000	91.	90.	51.	-15.	197.	-52.	234.	89.	69.	109.	62.	116.	28.
0004602000	30.	45.	97.	-162.	222.	-223.	283.	30.	19.	41.	15.	44.	53.
0004978000	30.	30.	10.	10.	50.	4.	56.	31.	16.	45.	11.	50.	37.
0004981000	30.	37.	26.	-21.	81.	-37.	97.	36.	-1.	72.	-12.	83.	66.
0004985000	30.	42.	107.	-181.	241.	-247.	307.	31.	22.	40.	19.	43.	49.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		99%		ITER D/I	CONFIDENCE INTERVALS 95%		99%		N
0004987000	61.	64.	28.	3.	119.	-18.	140.	56.	21.	90.	8.	103.	29.
0005013000	30.	31.	15.	-1.	61.	-13.	73.	30.	1.	58.	-10.	69.	22.
0005017000	30.	30.	15.	1.	59.	-8.	68.	30.	4.	55.	-4.	63.	48.
0005025000	91.	92.	19.	50.	132.	35.	147.	92.	51.	133.	36.	148.	23.
0005099000	61.	45.	115.	-166.	288.	-237.	359.	30.	24.	36.	22.	38.	58.
0005102000	30.	33.	21.	-11.	71.	-24.	84.	31.	7.	54.	-.	61.	56.
0005129000	30.	31.	6.	19.	41.	16.	44.	30.	23.	38.	20.	41.	86.
0005158000	61.	67.	22.	14.	108.	-3.	125.	62.	33.	90.	23.	101.	21.
0005217000	91.	90.	24.	40.	142.	23.	159.	83.	47.	118.	34.	131.	31.
0005263000	30.	30.	6.	19.	41.	15.	45.	30.	21.	40.	18.	43.	39.
0005272000	91.	93.	30.	29.	153.	7.	175.	91.	43.	140.	26.	157.	28.
0005350000	91.	92.	32.	24.	158.	.	182.	93.	64.	122.	54.	132.	28.
0005857000	30.	29.	33.	-35.	95.	-56.	116.	26.	-27.	78.	-45.	96.	33.
0005862000	30.	31.	32.	-34.	94.	-54.	114.	29.	-7.	64.	-18.	76.	68.
0005867000	30.	31.	26.	-22.	82.	-38.	98.	32.	6.	58.	-2.	66.	47.
0005877000	122.	136.	67.	-26.	270.	-84.	328.	147.	29.	266.	-19.	313.	15.
0005901000	30.	31.	87.	-141.	201.	-195.	255.	31.	6.	57.	-3.	65.	70.
0006642000	30.	32.	16.	-1.	61.	-11.	71.	30.	2.	58.	-7.	67.	43.
0006643000	91.	92.	51.	-21.	203.	-66.	248.	86.	40.	131.	21.	151.	15.
0006644000	30.	30.	29.	-28.	88.	-46.	106.	32.	13.	50.	8.	56.	49.
0006651000	61.	71.	49.	-43.	165.	-80.	202.	58.	15.	101.	-1.	118.	25.
0006708000	61.	64.	34.	-13.	135.	-39.	161.	60.	-3.	123.	-26.	146.	21.
0007343000	7.	7.	4.	-.	14.	-3.	17.	7.	.	14.	-2.	16.	110.
0007411000	30.	32.	19.	-11.	71.	-25.	85.	27.	4.	50.	-4.	59.	26.
0007602000	30.	30.	11.	7.	53.	.	60.	30.	15.	46.	10.	51.	49.
0008434000	91.	90.	18.	53.	129.	40.	142.	90.	53.	128.	39.	142.	22.
0008837000	30.	31.	29.	-26.	86.	-44.	104.	32.	5.	58.	-3.	66.	72.
0008843000	30.	31.	6.	18.	42.	14.	46.	30.	20.	40.	17.	43.	62.
0009096000	30.	32.	50.	-70.	130.	-101.	161.	29.	14.	43.	10.	48.	48.
0009097000	91.	93.	36.	17.	165.	-8.	190.	92.	29.	155.	7.	178.	31.
0009101000	91.	93.	34.	20.	162.	-5.	187.	93.	21.	164.	-4.	189.	27.
0009103000	61.	72.	46.	-30.	152.	-58.	180.	67.	-12.	145.	-39.	173.	33.
0009126000	7.	7.	23.	-38.	52.	-52.	66.	7.	4.	10.	3.	11.	86.

CONFIDENCE INTERVALS ABOUT THE MEAN ARRIVAL INTERVAL

SERIAL NUMBER	EXP. D/I	OBS. D/I	STD. DEV.	CONFIDENCE INTERVALS 95%		99%		ITER D/I	CONFIDENCE INTERVALS 95%		99%		N
0009130000	91.	92.	29.	34.	148.	16.	166.	98.	69.	128.	58.	138.	32.
0009320000	91.	94.	21.	46.	136.	30.	152.	99.	74.	124.	65.	134.	24.
0010510000	30.	31.	21.	-14.	74.	-30.	90.	28.	-4.	60.	-16.	72.	23.
0010621000	91.	92.	64.	-44.	226.	-92.	274.	92.	26.	159.	2.	182.	24.
0010627000	91.	100.	163.	-274.	456.	-418.	600.	104.	18.	191.	-20.	229.	14.
0010647000	122.	120.	42.	28.	216.	-9.	253.	120.	23.	218.	-17.	258.	15.
0010678000	61.	57.	48.	-43.	165.	-82.	204.	57.	11.	102.	-7.	120.	18.
0011036000	91.	95.	25.	38.	144.	18.	164.	91.	54.	129.	40.	143.	23.
0011037000	122.	123.	29.	59.	185.	36.	208.	123.	60.	186.	36.	210.	18.
0011040000	91.	92.	17.	56.	126.	43.	139.	92.	68.	116.	60.	124.	24.
0013784000	15[illegible].	33.	91.	-151.	211.	-208.	268.	33.	-14.	80.	-31.	96.	35.
0013794000	30.	31.	20.	-11.	71.	-26.	86.	33.	-5.	71.	-19.	84.	23.
0013797000	61.	67.	59.	-63.	185.	-108.	230.	67.	-73.	206.	-134.	267.	24.

EOJ *CSU04 03.11.71 ****

APPENDIX F

Journals Used In This Study

	Serial Identification Number	Name
1.	0000018000	AIAA Bulletin
2.	0000019000	AIAA Journal
3.	0000022000	A.I.Ch.E. Journal
4.	0000024000	A.I. Digest
5.	0000040000	ASHRAE Journal
6.	0000041000	ASLE Transactions
7.	0000050000	Aberdeen-Angus Journal
8.	0000095000	Accountant's Digest
9.	0000096000	Accounting Review
10.	0000099000	Acier. Stahl. Steel
11.	0000102000	Acoustical Society of America. Journal.
12.	0000113000	Acta Biochimica Polonica.
13.	0000116000	Acta Chemica Scandinavica.
14.	0000118000	Acta Chirurgica Scandinavica.
15.	0000126000	Acta Electronica.
16.	0000127000	Acta Endocrinologica.
17.	0000134000	Acta Geneticae Medicae et Gemellogicae.
18.	0000135000	Acta Geophysica Polonica.
19.	0000144000	Acta Medica Scandinavica.
20.	0000146000	Acta Metallurgica.
21.	0000180000	Acta Physiologica Scandinavica.
22.	0000200000	Acta Virologica.
23.	0000210000	Adhesives Age.
24.	0000211000	Administrative Management.
25.	0000212000	Administrative Science Quarterly.
26.	0000214000	Adult Education.
27.	0000217000	Advanced Battery Technology.
28.	0000221000	Advancement of Science.
29.	0000341000	Advertising and Sales Promotion.
30.	0000345000	Aeronautical Journal.
31.	0000346000	Aeronautical Quarterly.
32.	0000346100	Aerosol Age.
33.	0000347000	Aerospace Medicine.
34.	0000365000	The African Communist.
35.	0000369000	Africana.
36.	0000383000	Agricultural and Biological Chemistry.
37.	0000386000	Agricultural Aviation.
38.	0000387000	Agricultural Chemicals.
39.	0000392000	Agricultural Education Magazine.
40.	0000394000	Agricultural Engineering.
41.	0000398000	Agricultural Gazette of New South Wales.
42.	0000418000	Agriculture.
43.	0000421000	Agriculture in Northern Ireland.
44.	0000431000	Agronomy Journal.
45.	0000436100	Air Force and Space Digest.
46.	0000535000	Allgemeine Forst-und Jagdzeitung.
47.	0000536000	Allgemeine Forstzeitung.
48.	0000547000	America Indigena.
49.	0000548000	America Latina.
50.	0000554000	American Academy of Ophthalmology and Otolaryngology. Transactions.

Journals Used In This Study

	Serial Identification Number	Name
51.	0000568000	American Anthropologist.
52.	0000571000	American Antiquity.
53.	0000573000	The American Archivist.
54.	0000600010	American Association of Petroleum Geologists. Bulletin.
55.	0000613000	American Bar Association. Journal.
56.	0000615010	American Beef Producer.
57.	0000618000	American Behavioral Scientist.
58.	0000621000	American Bicyclist & Motorcyclist.
59.	0000640000	American Ceramic Society. Bulletin.
60.	0000641000	American Ceramic Society. Journal.
61.	0000646000	American Chemical Society. Journal.
62.	0000668000	American Corrective Therapy. Journal.
63.	0000678000	American Dairy Review.
64.	0000681000	American Dental Association. Journal.
65.	0000686000	American Dietetic Association. Journal.
66.	0000724000	American Fern Journal.
67.	0000729000	American Fisheries Society. Transactions.
68.	0000737000	American Forests.
69.	0000740000	American Fruit Grower.
70.	0000752000	American Geophysical Union. Transactions.
71.	0000765000	American Heart Journal.
72.	0000768000	American Highways.
73.	0000777000	American Imago.
74.	0000813000	American Journal of Archaeology.
75.	0000813250	American Journal of Art Therapy.
76.	0000816000	American Journal of Clinical Hypnosis.
77.	0000818000	American Journal of Clinical Nutrition.
78.	0000820000	American Journal of Comparative Law.
79.	0000821000	American Journal of Digestive Diseases.
80.	0000822000	American Journal of Diseases of Children.
81.	0000823000	American Journal of Economics and Sociology.
82.	0000824000	American Journal of Epidemiology.
83.	0000826000	American Journal of Human Genetics.
84.	0000832000	American Journal of Medical Technology.
85.	0000834000	American Journal of Mental Deficiency.
86.	0000835000	American Journal of Nursing.
87.	0000836010	American Journal of Obstetrics and Gynecology.
88.	0000839000	American Journal of Ophthalmology.
89.	0000846000	American Journal of Pharmacy.
90.	0000848000	American Journal of Physical Anthropology.
91.	0000849000	American Journal of Physical Medicine.
92.	0000850000	American Journal of Physics.
93.	0000852000	American Journal of Psychiatry.
94.	0000853000	American Journal of Psychology.
95.	0000856000	American Journal of Public Health and the Nation's Health.
96.	0000858000	American Journal of Roentgenology, Radium Therapy and Nuclear Medicine.

Journals Used In This Study

	Serial Identification Number	Name
97.	0000860000	American Journal of Sociology.
98.	0000861000	American Journal of Surgery.
99.	0000864000	American Journal of Tropical Medicine & Hygiene.
100.	0000867000	American Journal of Veterinary Research.
101.	0000887000	American Machinist.
102.	0000922000	American Medical Association. Journal.
103.	0000949000	American Naturalist.
104.	0000957000	American Oil Chemists Society. Journal.
105.	0000998000	American Psychologist.
106.	0001010000	American Review of Respiratory Diseases.
107.	0001013000	American Rifleman.
108.	0001019000	American Scholar.
109.	0001043000	American Society for Training & Development. Journal.
110.	0001054000	American Society of Chartered Life Underwriters. Journal.
111.	0001110000	American Sociological Review.
112.	0001116000	American Statistical Association. Journal.
113.	0001150000	American Vegetable Grower.
114.	0001166000	American West.
115.	0001173000	Americas.
116.	0001175000	Amusement Business.
117.	0001195000	Anesthesia and Analgesia...Current Researches.
118.	0001263000	Annals of Iowa. Third Series.
119.	0001264000	The Annals of Mathematical Statistics.
120.	0001272000	Annals of Public and Cooperative Economy.
121.	0001335000	The Antioch Review.
122.	0001340000	Antitrust Bulletin.
123.	0001378000	The Appraisal Journal.
124.	0001485000	Arizona and the West: A Quarterly Journal of History.
125.	0001499000	Arizona Quarterly.
126.	0001615000	Asian Survey.
127.	0001622000	Asphalt.
128.	0001648000	Association of Official Analytical Chemists.
129.	0001665000	Astrophysical Journal.
130.	0001678000	Atlantic Monthly.
131.	0001682000	Atlas.
132.	0001773000	Automation.
133.	0001777000	Avian Diseases.
134.	0001782000	Aviation Week and Space Technology.
135.	0001802000	Ball State University. Forum.
136.	0001829000	Behavioral Science.
137.	0001880000	Best's Review: Life & Health Insurance Edition.
138.	0001881000	Best's Review: Property & Liability Edition.
139.	0001996000	Biological Bulletin (U.S.)
140.	0002017000	Biometrics.

Journals Used In This Study

	Serial Identification Number	Name
141.	0002019000	Biophysical Journal.
142.	0002196000	British Grassland Society, Journal.
143.	0002206000	British Journal of Aesthetics.
144.	0002207000	British Journal of Anaesthesia.
145.	0002217000	British Journal of Experimental Pathology.
146.	0002220000	British Journal of Industrial Relations.
147.	0002221000	British Journal of Mathematical and Statistical Psychology.
148.	0002222000	British Journal of Medical Psychology.
149.	0002232000	British Journal of Radiology.
150.	0002233000	British Journal of Social and Clinical Psychology.
151.	0002234000	British Journal of Sociology.
152.	0002236000	British Journal of Surgery.
153.	0002237000	British Journal of Urology.
154.	0002239000	British Medical Bulletin.
155.	0002240000	British Medical Journal.
156.	0002253000	British Poultry Science.
157.	0002260000	British Veterinary Journal.
158.	0002265000	Broadcasting.
159.	0002276000	Brown Boveri Review.
160.	0002283000	Bryologist.
161.	0002314000	Building Materials Merchandiser.
162.	0002329000	Bulletin of Epizootic Diseases Of Africa.
163.	0002331000	Bulletin of Hispanic Studies.
164.	0002332000	Bulletin of Marine Science.
165.	0002333000	Bulletin of Mathematical Biophysics.
166.	0002348000	Bunseki Kagaku.
167.	0002357000	Burroughs Clearing House.
168.	0002361000	Business Automation.
169.	0002368000	Business History Review.
170.	0002372000	Business Management.
171.	0002374000	Business Screen Magazine.
172.	0002378000	Business Week.
173.	0002672000	Canadian Chartered Accountant.
174.	0002675000	Canadian Entomologist.
175.	0002681000	Canadian Field-Naturalist.
176.	0002702000	Canadian Journal of Chemical Engineering.
177.	0002712000	Canadian Journal of Microbiology.
178.	0002713000	Canadian Journal of Occupational Therapy.
179.	0002926000	Chemistry in Britain.
180.	0003103000	College and University Journal.
181.	0003105000	College Board Review.
182.	0003108000	College Management.
183.	0003799000	Cytogenetics.
184.	0003829000	Dansk Skovforening Tidsskrift.
185.	0003918000	Deutsche Tierarztliche Wochenschrift.
186.	0003997000	Domus.
187.	0004099000	Economic Geology.
188.	0004194000	Electronic Engineering.

Journals Used In This Study

	Serial Identification Number	Name
189.	0004267000	Engineering News-Record.
190.	0004284000	English Studies.
191.	0004293000	Entomological News.
192.	0004341000	Esquire.
193.	0004348000	Ethics.
194.	0004599000	Finance and Development.
195.	004602000	Financial Executive.
196.	0004978000	Gastroenterology.
197.	0004981000	Gazetta Chemica Italiana.
198.	0004985000	Gems and Minerals.
199.	0004987000	General and Comparative Endocrinology.
200.	0005013000	Genetika (Akademiia Nauk SSSR)
201.	0005017000	Geochimica et Cosmochimica.
202.	0005025000	Geographical Journal (London)
203.	0005099000	Geriatrics.
204.	0005102000	German International.
205.	0005129000	Gleanings in Bee Culture.
206.	0005158000	Graphis.
207.	0005217000	Growth.
208.	0005263000	Harper's Magazine.
209.	0005272000	Harvard Educational Review.
210.	0005350000	Health Laboratory Science.
211.	0005857000	Indian Chemical Society. Journal.
212.	0005862000	Indian Farming.
213.	0005867000	Indian Forester.
214.	0005877000	Indian Journal of Genetics and Plant Breeding.
215.	0005901000	Indian Veterinary Journal.
216.	0006642000	Japanese Forestry Society. Journal.
217.	0006643000	Japanese Journal of Applied Entomology and Zoology.
218.	0006644000	Japanese Journal of Applied Physics.
219.	0006651000	Japanese Journal of Medical Science and Biology.
220.	0006708000	Journal de Physiologie.
221.	0007343000	Lancet.
222.	0007411000	Lesnaia Promyshlennost'
223.	0007602000	Maclean's.
224.	0008434000	Municipal Finance.
225.	0008837000	Die Neuren Sprachen.
226.	0008843000	Neurology.
227.	0009096000	New Zealand Journal of Agriculture.
228.	0009097000	New Zealand Journal of Botany.
229.	0009101000	New Zealand Journal of Science.
230.	0009103000	New Zealand Science Review.
231.	0009126000	Newsweek.
232.	0009130000	Nieman Reports.
233.	0009320000	Nutrition Abstracts and Reviews.
234.	0010510000	Referatiivngi. Zhurnal. Astronomiia (Academiia Nauk SSSR Institut Nauchnni Informatsii)

Journals Used In This Study

	Serial Identification Number	Name
235.	0010621000	Reviews of Modern Physics.
236.	0010627000	Revista D.A.E.
237.	0010647000	Revista Latinoamericana de Socio Logia.
238.	0010678000	Revue Francaise de Science Politique.
239.	0011036000	Scottish Forestry.
240.	0011037000	Scottish Geographical Magazine.
241.	0011040000	Scottish Journal of Occupational Therapy.
242.	0013784000	Zhurnal Mikrobiologii, Epidemiologii I Immunobiologii.
243.	0013794000	Zoologicheskii Zhurnal.
244.	0013797000	Zoologischer Anzeiger.